CHARUSAT
CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

STUDENT'S HANDBOOK

First Year B. Tech Programme

(CL / ME / EE)

Faculty of Technology & Engineering

Chandubhai S. Patel Institute of Technology

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PART A

GENERAL INFORMATION

CHARUSAT LEGENDS & TERMINOLOGY

CHARUSAT legends are the abbreviation and acronym of the terms used at the university. CHARUSAT legends also include some important terms used at the academic life of the University. The legends are being used to simplify and facilitate rapid communication.

Legends

CHARUSAT	CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
CSPIT	Chandubhai S Patel Institute of Technology
DEPSTAR	Devang Patel Institute of Advance Technology and Research
RPCP	Ramanbhai Patel College of Pharmacy
PDPIAS	P D Patel Institute of Applied Sciences
CMPICA	Smt. Chandaben Mohanbhai Patel Institute of Computer Applications
I2IM	Indukaka Ipcowala Institute of Management
ARIP	Ashok & Rita Patel Institute of Physiotherapy
MTIN	Manikaka Topawala Institute of Nursing
CIPS	Charotar Institute of Paramedical Science
CSMCRI	Central Salt and Marine Chemicals Research Institute
CHRF	Charusat Healthcare & Research Foundation
CSRTC	Charusat Space Research and Technology Centre
HRDC	Pri. B. I. Patel Human Resource Development Centre
KRADLE	Dr. K C Patel Research & Development Centre
CREDP	Charusat Rural Education Development Program
UIIC	University Industry Interaction Cell
CDPC	Career Development and Placement Cell
EDIC	Entrepreneurship Development & Incubation Cell
EOC	Equal Opportunity Cell
IQAC	Internal Quality Assurance Cell
CPSH	Cell for Prevention of Sexual Harassment

ARC	Anti-Ragging Committee
ISC	International Student Cell
GRC	Grievance Redressal Cell
WDC	Women Development Cell
WINCELL	Wireless Information and Networking Cell
CAA	CHARUSAT Alumni Association

Terminology

Definitions of Key Words:

1) Academic Year: Bachelor of Technology (B.Tech) is the 4-year Course shall be divided into 8 independent semesters with two semesters (One Odd + One Even) in one academic year.

2) Semester: Shall constitute of 26 weeks. Each semester shall have minimum 90 days of direct class room teaching, tutorials, counseling, project work and self-learning.

3) Programme: An educational programme leading to award of a Degree, Diploma or Certificate.

4) Course: Course is a subject in a given semester of a particular programme with given credits and teaching plan leading to an examination.

5) Choice Based Credit System (CBCS): The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).

6) Credit Based Semester System (CBSS): Under the CBSS, the requirement for awarding a degree or diploma or certificate is prescribed in terms of number of credits to be completed by the students.

7) Credit: means a unit by which the coursework is measured. As a general guideline, one credit means one hour of class room teaching or minimum one and half to two hours of practical work per week.

8) Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

9) Credit Point: It is the product of grade point and number of credits for a course.

10) Letter Grade: Is a parameter to indicate the performance of a student in a particular course.

11) Percentage: The result obtained by multiplying a quantity by a percent. Or proportion or rate per hundred parts. The percent value is computed by multiplying the numeric value of the ratio by 100.

12) Semester Grade Point Average (SGPA): It refers to the performance of a student in a given semester. SGPA is ratio of the ‘sum of all the products of credit points and grade point earned

by the student in all courses of the semester' and the 'total number of credits of all subjects offered in that semester'.

13) Cumulative Grade Point Average (CGPA): It refers to the performance of the student in all completed semesters and is equal to Cumulative Grade Point Weighted Average.

14) Transcript: A transcript issued to the student at the time of leaving the university will contain a consolidated record of all the courses taken by him / her, grades obtained and the final CGPA.

STUDENT'S CORE COMMITMENTS

CHARUSAT is committed to nurture academic, personal and social values in the students; and expects the students to practice the following Core Commitments of academic, personal and social Responsibility.

ACHIEVING EXCELLENCE

Developing a strong work ethic and consciously doing one's excellent in all aspects of the university.

CULTIVATING, PERSONAL & ACADEMIC INTEGRITY

Recognizing and acting on a sense of respect and dignity both by being honest in relationships and by upholding academic integrity.

CONTRIBUTING TO A LARGER COMMUNITY

Recognizing and acting on one's responsibility to the educational community, the local community, and the wider national and global society.

TAKING SERIOUSLY THE VIEWPOINT OF OTHERS

Recognizing and acting on the responsibility to inform one's own judgment; and engaging various and competing viewpoint as a resource for learning, citizenship, and work.

ENLIGHTENING, ETHICAL AND MORAL REASONING

Developing moral reasoning in ways that incorporate the other four responsibilities and using such reasoning in learning and in life.

ACADEMIC LIFE

CHARUSAT wants all students to achieve their highest academic potential and makes faculty and academic support resources available to assist each student in meeting his/her academic goals.

F Teacher

Students needing assistance with a specific course should first seek the help of the teacher. Maintaining continued contact with a teacher and staying informed of academic status in a course is recommended.

F Counselor

Each student has a counselor who is knowledgeable about the course the student is pursuing and available to help the student to any academic issue. In addition, the counselor is available to counsel students on all matters related to being a university student as well as on life issues.

F Libraries, Laboratories and Workshops

The university has established libraries, laboratories and workshops for an interactive and engaging learning experience.

F Attendance Policy

Every institute of CHARUSAT has its own attendance policy; students are required to fulfill the criteria of attendance. Students are required to understand and follow the attendance policy of their institute.

F Training and Placement Services

Training and Placement Services at CHARUSAT offers counseling on the choice of a course based on a student's abilities and career interests, as well as networking opportunities with recruiters for potential employment.

ACADEMIC INTEGRITY

CHARUSAT strongly recommends honesty and integrity in all academic work.

Academic Integrity is an ethical practice that means students are achieving academic success fairly. It suggests that all results that are achieved are earned honestly.

Your education is an investment; not maintaining academic integrity may devalue your education, which affects the worth of your degree. Academic Integrity is essential for any society, as people citizens need to trust that who are in positions of authority have earned their credentials rightfully.

Students are expected to exhibit integrity by being truthful about their own academic work and properly acknowledging sources of ideas and information.

Ø Cheating in any form is not tolerated

Cheating Includes:

- Assignment, such as requesting or accepting answers on a quiz or test from another student who has already taken it,
- Discussing test information to any extent with other students, transmitting quizzes or tests or answers to quizzes or tests electronically to other students via cellphone, email, etc.
- Including turning in someone's work as one's own(another student's, a purchased paper from an online source, etc.)

Ø Plagiarism is another form of cheating and academic dishonesty. Intentional or unintentional plagiarism is an offense

Plagiarism includes:

- Use to any degree of the ideas or words of one's source material without proper acknowledgement. Plagiarism typically takes two forms:
- Failure to acknowledge the use of an author's ideas or organization by footnote or identification of the source in the text of the paper.
- Incomplete paraphrase (mere rearrangement of syntax and substitution of synonyms for the author's words) is plagiarism.
- Failure to acknowledge the use of an author's words by quotation marks, as well as by footnote or identification in the text.
- You may consult your teacher or counselor to know more on how to avoid cheating, plagiarism and maintain academic integrity.

SOCIAL LIFE

CHARUSAT's overarching goal is to teach students how to live. To help students experience long-term social success.

CHARUSAT provides ample opportunities to students to enhance their social life on campus. There are many activities, clubs and events organized to enhance student's social interactions and skills.

Ø CHARUSAT PROMOTES

- F **Healthy Friendship**
- F **Group Activities**
- F **Enhancement of Fraternity**
- F **Respect for Others**
- F **Dignity in Behavior**
- F **Upholding Social and Moral Values**
- F **Outreach Activities in the Society**
- F **Development of Network**

CODE OF CONDUCT

Statement of Expectations

As members of the university's community, all students, groups of students, and student organizations are expected to exemplify CHARUSAT's community principles and values, to engage in socially responsible behavior, and to model exceptional conduct, character, and citizenship on campus and beyond.

Parent or Family Contact

Contact with a student's parents or legal guardians may occur or be required in certain circumstances in connection with a matter involving alleged student misconduct or any other academic or personal matter.

Hostel Life

Students are required to follow the rules of the respective residential facility. A decent decorum should be maintained while living in the hostels or any other residential facilities.

Wi-Fi & Internet

CHARUSAT campus is Wi-Fi enabled; moreover, all computers are equipped with internet facility. Students are required to use this facility with maximum integrity. Any misuse of it or misconduct through it will lead to punishment or penalty.

Infrastructure and Instruments

CHARUSAT campus is beautifully designed. All classrooms, laboratories and other areas of the campus are equipped with various amenities and academic instruments. Students are required to use amenities and academic instruments with maximum integrity. Any misuse of it or misconduct through it will lead to punishment or penalty.

Social Media

Social Medias such as Facebook, Twitter, What’s App etc. are part of our daily life but it is recommended that all students maintain dignity in the content of posting/ commenting about others and the university.

Communication Devices

Use of cell-phones and other communication devices in the classroom, laboratories, libraries, and at other academic area are prohibited.

Dressing

Students are required to maintain dignified appearance. You may dress up with formal or semi• Formal cloths and accessories.

Prayer

CHARUSAT respects all religion. There is a tradition of prayer recitation at the campus premises through Public Address System at 8:55 am. All are requested to maintain the dignity of the prayer time.

DO'S & DON'TS

Do's

- þ Set your academic goal high
- þ Attend classes regularly
- þ Participate in all activities & events
- þ Take class notes regularly and refer to them when required
- þ Speak to your teachers and counselor about your any academic or personal issues
- þ Speak to administration for any issues or problems related to student services
- þ Participate in, or create a study group
- þ Keep the campus clean
- þ Socialize with your peers and develop strong professional relationships
- þ Maintain regular contact with your parents to report both good news and bad news
- þ Maintain codes of conducts in any kind of communication - oral or written
- þ Complete your assignments, projects or any other academic work on time
- þ Inspect properly the place before renting resident outside the campus
- þ Ask what you can do to help others
- þ Consult CHARUSAT website and notice boards regularly for any updates and announcements

Don'ts

- ý Wander around the unknown peripheral areas of the campus
- ý Share personal information to unknown
- ý Damage any property of the campus
- ý Leave your personal belongings unattended
- ý Participate in or initiate gossips or rumors
- ý Make loud noise or create confusion in the class room, auditorium or elsewhere in the building
- ý Use abusive language
- ý Assume your first and second semester marks don't count. CGPA's of your whole program are looked at during applications for further studies and career
- ý Use cell-phones or any other communication devices in the classroom or any other part of the building where academic activities are going on

STUDENT SERVICES

CHARUSAT strongly believes that a student's life at the campus should be comfortable and hassle-free, and for that the university has carefully designed various services for the students. You are requested to avail the services as and when required.

& Library &

- The Knowledge Resource center (Central Library) - a proud partner in the institute's march towards its vision, plays a vital role in acquisition, organization and dissemination of knowledge. You shall need this for almost all your academic assignments!
- It has an excellent collection of both print and electronic books, journals, technical reports, back volumes and other reading material. It has adequate infrastructure to meet its requirements, has computerized all its operation using software developed in-house, and provide access to the collection through Online Public Access Catalogue (OPAC).
- Along with the Central Library, there are Institute Level Libraries in each Institute Building. The Libraries are enriched with more than 50,000 books and 15,000 journals (including e-journals).
- The Knowledge Resource Centre maintains a e-resource access center containing 25 computer terminals for the students in which they can access national and international e resources namely IEEE, ASME, AIP, IOP, IPS, CSPIT library database containing CD's, e-books, journals, Project Reports, Syllabus, University Exam papers through Intranet (ftp://172.16.1.14). Moreover separate computer terminals provide to students with CD writer and USB port for their presentation of seminar, project work and day to day work. The E-resources can be accessed through other computer terminals anywhere in campus. Try learning more on this!!

For any queries, you may please contact the Library office
Contact Person: Mr. Dinesh Patel, Librarian
Contact Number: (02697) 265032; 9909543820
Contact Email: dineshpatel.lib@charusat.ac.in

Residences

- The residences for girls are available at CHARUSAT Campus and residences for boys are available adjacent to campus.
- The life in hostels enables students to spend ample time at the university utilizing library and other facilities to ensure they develop academically and acquire the necessary skills that can be obtained only through experience.

For any queries, you may please contact
Contact Person: Mr. Hasmukh Patel
Contact Number: (02697) 265004; 9426500630
Contact Email: hasmukhpatel.adm@charusat.ac.in

Transport Services

- CHARUSAT has outsourced bus services for providing the transportation facilities to the students.
- A fleet of buses are there for transporting students and staff from different locations in Ahmedabad, Vadodara, Anand and Nadiad and nearby villages every day. A VITCOS bus service has been initiated for students from Anand at a very minimal rate.
- Students are supposed to pay directly to the travel company either monthly or six-monthly or yearly installments.

For any queries, you may please contact
Contact Person: Mr. Dharmendra Patel
Contact Number: (02697) 265018; 9586967008
Contact Email: dharmendrapatel.adm@charusat.ac.in

Healthcare

- CHARUSAT Hospital is established to provide primary health care services for emergency and daily health cases. It organizes periodical health screening programs and health awareness activities and campaigns.

For any queries and emergencies you may please contact
CHARUSAT Hospital, Reception Desk
Contact Number: (02697) 265291; 9537927873

Student Safety Cells

- CHARUSAT believes that it should be a safe workplace as well as a safe place to study. All the students of CHARUSAT may avail following help if need arises:

Cell for Prevention of Sexual Harassment (CPSH)
Please call on 7600414303 for complaints
https://www.charusat.ac.in/ac/cells-at-charusat/

Anti-Ragging Committee (ARC)
Please call on 09925830781 for complaints.
https://www.charusat.ac.in/ac/cells-at-charusat/

: Wincell :

F The Wireless Information and Networking Cell, is the Cell looking after IT Infrastructure of CHARUSAT. CHARUSAT is a Wi-Fi zone with 100 mbps connectivity. Internet is available on each computer terminals. For all your queries like Internet Access, Printing or other such issues, contact Wincell Department.

For Wincell Department, you may please contact
Contact Person: Mr. Ritesh Bhatt
Contact Number: (02697) 265106; 9924444809
Contact Email: riteshbhatt.win@charusat.ac.in

ÿ E-Governance ÿ

F Almost all the process of CHARUSAT are computerized and connected through customized Entrepreneurs Resource Planning Software. This whole system is called E-Governance. The students shall be needing to access these system for registration, syllabus, time-table, attendance, student I-card, Fees and other receipts, exam results, convocation form, interaction platforms with teachers like blogs, etc.

For any queries or details, you may please contact
Contact Person: Mr. Alok Patel
Contact Number: (02697) 265243; 9879582027
Contact Email: alokpatel.mca@charusat.ac.in

F Each department has an E-Governance Representative. You may contact Principal of your Institute for further details.

z Study Foyer z

F There is a special area dedicated for reading. It is located on the first floor near central library.

! Reprography & Stationery !

F There are facilities for reprography (photocopy) and buying stationeries on campus. It is located on the first floor near central library.

‘ Bank, Post & ATM ‘

F There are facilities of banking and post in campus. It is located in the central administrative building, and ATM facility is just near to campus.

CAREER DEVELOPMENT & PLACEMENT CELL

The Motive of Charotar University of Science and Technology (CHARUSAT), Changa is to help society to develop towards a better future. We believe in providing value based education to the students so that they can be better employable candidates and more importantly an individual contributing to the organization and the society as a whole.

For the same purpose, a dedicated centralized Career Development and Placement Cell has been constituted on the campus. The Cell coordinates all the Training and Placement activities of different institutes of the University and enhances Industry Institute Interaction

, Training Activities ,

F Training activities are arranged at two levels i.e. CDPC and institute or department wise. The training programmes are concentrated towards providing students with ample exposure to recruitment patterns and skill requirements of different private and public sector organizations. The training programs offered include Behavioral Skills, Technical Skills, Personality Improvement, and Communication Skills.

F Each Institute provides Training in accordance with the curriculum/course. Training is provided to them in coordination with different Private/Public organization according to prevalent Industry demand. This is undertaken to provide the student with the real time environment in industry so that the student can have a firsthand practical experience of the latest practices and technologies. The duration of the training can differ according to specific course and its need. The Training Cell also arranges program on Behavioral Skills and Technical Skills Training to the students prior to facing Campus Placements.

G Placement Activities G

F The Robust and Dedicated Centralized Placement Cell facilitates On-Campus / Pooled Campus / Off-Campus activities to provide job assistance to students in leading organization. The Placement Department in coordination with Institute Placement Coordinator invites reputed organization for placements activities. All the Major Industry and Sector are targeted to make provide ample opportunities to the students.

, Career Guidance ,

F Career Guidance Career Development and Placement Cell also organizes Seminars/Workshops/Training Programs/Guest Lectures on various career avenues and options that a student could explore (GATE/GRE/TOEFL/CAT/UPSC/GPSC etc). Sectoral Inputs are provided to students to make wise choices about the sector they choose to build their career.

G Resume Building and Interview Preparation G

F The cell guides students on how to prepare appropriate Resume/CV including video resume and how to prepare for the interviews. Special sessions on technical / aptitude / soft and employability skills are conducted in house as we well as by inviting Industry experts to provide students more exposure and improve their employability.

, Placement Infrastructure ,

F The University has state of the art infrastructure with 24X7 Wi-Fi Campus, Internet Connectivity, Several Large network line Labs and Auditoriums and Seminar halls for conducting Placement Drives. CHARUSAT has also hosted Pooled Campus Drives for Infosys, Amdocs, and Alembic to name a few, for the entire region.

For further information, you may please contact
Training & Placement Officer
Contact: Prof. Ashwin Makawana, Mr. Divyang Purohit, Mr. Ernest Stevens
Contact Number: (02697) 265213; 9913686259
Email: tnp@charusat.ac.in, divyangpurohit.tnp@charusat.ac.in

There are also T&P co-coordinators in each Department; you may contact HOD of your department to know more.

STUDENT PROFESSIONAL ACTIVITIES

Y Student Chapters, **Societies and Academies** Y

	● IEEE is the world's largest professional association dedicated to advancing technological innovation and excellence for the benefit of humanity. CHARUSAT is an official Student Branch of IEEE. Tech Enthusiastic Student IEEE Members of CHARUSAT organizes technical activities like workshops, seminars and Technical Festivals to motivate and increase other student's interest in technical research and innovations. IEEE Student Branches are established at universities and colleges around the world. Within IEEE, activities are organized geographically by Region and local Section. Student Branches in R10 with Counselor & Chair contact August 2015, CHARUSAT University is one of the active Student branch in Asia and Pacific Region.
	● CHARUSAT University is affiliated with IWS Academy and convert affiliation to a life time relationship. Charusat University initiates a new concept named IEEE TECH WINDOW. It is a technical Wall. A medium for students to share the technical updates with each other.
	● The Association for Computing Machinery is an international learned society for computing, founded in 1947. ACM is the world's largest educational and scientific computing society, delivers resources that advance computing as a science and a profession. ACM is solely dedicated to computing. ACM provides the computing field's premier digital library and serves its members and the computing profession with leading-edge publications, conferences and career resources. CHARUSAT is an official Student Chapter of ACM initiated by Department of Information Technology, CSPIT on 26 th August 2016.
	● Microsoft Technology Associate (MTA) ● Microsoft Certified Solutions Associate (MCSA) ● Microsoft Certified Solutions Expert (MCSE) ● Microsoft Certified Solutions Developer (MCSD)
	● Oracle Certified Associate (OCA) ● Oracle Certified Professional (OCP) ● Oracle Certified Master (OCM) ● Oracle Certified Expert (OCE) ● Oracle Certified Specialist (OCS) Oracle Certified Associate Java SE Programmer. ● Oracle Certified Professional Java SE Programmer.

	● Cisco Certified Network Associate 1 (CCNA 1) ● Cisco Certified Network Associate 2 (CCNA 2) ● Cisco Certified Network Associate 3 (CCNA 3) ● Cisco Certified Network Associate 4 (CCNA 4) ● Cisco Certified Network Professional (CCNP)
	● CCNSP: Cyberoam Certified Network & Security Professional
	● Red Hat System Administration I (RH124) ● Red Hat System Administration II (RH134 / RH135) ● Red Hat Certified System Administrator (RHCSA) ● Red Hat System Administration III (RH254/RH255) ● Red Hat Certified Engineer (RHCE)
	● The chapter is established in the year 2007 to provide a platform to students to help in applying their technical skills to practical aspects. This chapter has conducted various expert lectures, Two National level TECHFEST in the year 2008 and 2010 and more than 15 various workshops to practical exposure. ● Some of the Chapter activities are: Technical Quizzes, Circuit Designing Circuit analysis and fault finding, Elocution, Seminars and workshops, Poster presentations, Concept and idea presentation and exhibitions, Technical treasure hunts, Expert lectures
	● The ISHRAE student chapter in CHARUSAT have been established to promote the activities to protect the Environment, improve Indoor Air Quality, help Energy Conservation, provide continuing education to the Members and others in the HVAC & related user Industries and offer certification programs, career guidance to students. ● Some of the Chapter activities are:Industrial visit, Guest Lecture, Quiz,Seminars etc.
	● SAEINDIA is an affiliate society of SAE International, registered as an Indian non profit engineering and scientific society dedicated to the advancement of mobility community in India. As an individual member driven society of mobility practitioners, SAEINDIA comprises members who are individuals from the mobility community, which includes engineers, executives from industry, government officials, academics and students. Principal emphasis is placed on transport industries such as automotive, aerospace, and commercial vehicles. ● SAEINDIA sections were formed all across the country.In 2008, Formula SAEINDIA was launched with the name of SUPRA SAEINDIA. This event provides a real world engineering challenge for the SAEINDIA student members that reflects the steps involved in the entire process from design and engineering to

	production to marketing and endurance. ● Since last four years 'Team Ojaswat' a team of 25 students from Charusat University has been participating in SUPRA SAEINDIA. The main aim of the event is to design, make and maintain Student Formula car. Almost 150 universities from all over India participate in this competition. Right from SUPRA'14 students of Charusat University have proved their mettle. In year 2014, the team secured 3rd rank overall, 1st in endurance and also achieved 'Go Green' Award. After a setback in 2015 where team could not clear the brake test, the students again proved themselves in SUPRA'16. Out of 168 universities team was 5th all over India. They also secured 2nd rank in skid-pad event. And recently the team cleared technical Inspection in First attempt as a debut in Formula Bharat an International Event in Jan'17.
	● Society of Civil Engineering (SCE) is a non-registered non-profit academic initiative taken by the Department of Civil Engineering, Chandubhai S. Patel Institute of Technology under the governance of Charotar University of Science and Technology. The SCE is a society with a group of nascent engineers committed to experience high applications of civil engineering concepts on field with an objective of promoting civil engineering, bring new technologies in civil engineering to the grass root level of the human society through students and promote environmentally sustainable construction technologies.
FESTO Centre of Excellence 	FESTO Didactic has been recognized worldwide for the development of high-quality, intuitive learning systems for technical education. FESTO Didactic brings over 40 years of experience into developing solutions for fast learning and successful retention over a broad spectrum of technologies. FESTO Centre of Excellence at CHARUSAT has learning and training facilities for pneumatic systems, hydraulic systems and factory automation. It is an experience center in true sense. 

STUDENT ACTIVITIES & EVENTS

O NSS & NCC O

F CHARUSAT offers training for NSS and NCC for interested students. Interested students may please contact the Sports and Gymnasium Coordinator

For any queries or details, you may please contact
Contact Person: Mr. Yogesh Jani
Contact Number: (02697) 265036; 9558295583
Contact Email: yogeshjani.sports@charusat.ac.in

% Co-Curricular & Cultural Events %

F A vast range of cultural and social activities are available to CHARUSAT students, faculty and staff. Getting involved in campus life is the quickest way to become a part of the University community, and to create one's own CHARUSAT experience. Campus life activities are built around the concepts of encouraging each community member to express his or her talents and to respect all members of our pluralistic community.

F The students can exhibit their special talents by the multiple college and inter-college competitions within and outside the campus. CHARUSAT organizes a four day gala event of University level Cultural Competition named SPOURAL. In addition, CSPIT organizes COGNIZANCE - TECH FEST, a state level technical event annually.

F The University also encourages the students and staff to celebrate all the varied festivals at the campus like Uttrayan, Holi, Navratri, Ganesh Chaturthi, etc.

RECREATION & REFRESHMENTS

† Sports & Gymnasium †

- CHARUSAT campus offers wide range of team sports, exercises, fitness and other related activities. Selected activities include various indoor and outdoor games like badminton, table tennis, cricket, volleyball and football, gymnasium, etc.
- The gym is open from 9am to 5pm. Please remember to bring your student ID card every time you visit the gym and you also have to bring sport shoes. Non-sport shoes will not be allowed in the gym.

Sr. No.	Activities	Timing
1.	University Fitness Center Ground Floor, ARIP Building	Morning 6:00 a.m. to 8:00 a.m. For Girls and Female Faculty
		Evening 4:30 p.m. to 7:30 p.m. For Boys and Male Faculty
2.	University Gymnasium 1st Floor, Hari Om Food Plaza Building	Morning 6:00 a.m. to 8:00 a.m. for Boys and Male Faculty
		Evening 4:30 p.m. to 7:00 p.m. For Girls and Female Faculty
3.	Indoor Sports for Boys and Girls	Evening 4:30 p.m. to 7:00 p.m.

You may please contact the Sports and Gymnasium Coordinator
Contact Person: Mr. Yogesh Jani
Contact Number: (02697) 265036; 9558295583
Contact Email: yogeshjani.sports@charusat.ac.in

ä Food ä

- The campus cafeteria and other food outlets are open every class day, serving breakfast, lunch and snacks. You can bring your own snack/lunch also. The Campus Cafeteria is situated at Lake Side serving multiple cuisine food. The other Fast Food Outlets like Nescafe and Iceberg are also available at the campus.

For any queries, you may please contact
Contact Person: Mr. Hasmukh Patel
Contact Number: (02697) 265004; 9426500630
Contact Email: hasmukhpatel.adm@charusat.ac.in

FINANCIAL INFORMATION

• Insurance •

CHARUSAT believes in the safety of the students. Hence, it has insured each and every student of the campus with the Group Personal Accident Insurance Policy.

For Further Details, You May Please Contact

Contact Person: Mr. Bhavdip Patel, Chief Accounts Officer

Contact Number: (02697) 265024; 9925946858

Contact Email: bhavdippatel.acc@charusatac.in

• Financial (Aid) Scholarships •

CHARUSAT provides its students' with a number of financial support opportunities. These opportunities are exclusively focused on providing support for students whose financial conditions may prevent them from continuing their education.

Ø Following Scholarship schemes are available which are mentioned below :

Name of Scholarship	Beneficiaries
CHARUSAT Merit Scholarship (CMS-2015) (CMS-2016)	All students who satisfy stipulated percentile criteria.
GPAT Scholarship (By AICTE)	As per Government norms.
Government Scholarship	All students of SC, ST and SEBC category, Free ship card for SC students, Chief Minister Scholarship Scheme, Mukhyamantri Yuva Swavalamban Yojna (MYSY (http://mysy.guj.nic.in/).
MOMA Scholarship	Students belonging to minority communities.
Late Maniben Shankarbhai Patel Scholarship (Implemented from 2014-15)	1st Rank of 2nd, 3rd & 4th year student of B.Sc Nursing Program.

Name of Scholarship	Beneficiaries
Late Shankarbhai Chhaganbhai Patel Scholarship (Implemented from 2014-15)	1st Rank of 2nd, 3rd & 4th year student of B.Pharm Program.
Late Dahiben Ravjibhai Patel & Dineshbhai Ravjibhai Patel Merit Cum Means Scholarship (2016-17)	Meritorious & Economically Constrained Students of IT branch of CSPIT
Urmil & Mayuri Desai Family Trust Scholarship (2016-17)	Meritorious & Economically Constrained Students of Engineering of CSPIT
Umedbhai Dharamdas Patel (Nar) Charitable Trust Scholarship	Meritorious & Economically Constrained Students of Selected Course
CHAMOS CHARUSAT Merit Cum Means Scholarship	Students of Charotar Moti Satavis Patidar Samaj, who take admission at CHARUSAT University.

For any further queries, you may please contact

Contact Person: Mr. Darshan Patel

Contact Number: (02697) 265027; 8866286880

Contact Email: darshanpatel.adm@charusat.ac.in

PART B

ACADEMIC INFORMATION

Faculty of Technology & Engineering

cspit

Chandubhai S Patel
Institute of Technology

ACADEMIC REGULATIONS & SYLLABUS

(Choice Based Credit System)

Bachelor of Technology Programme

(First Year B. Tech Programme **CL/ ME/ EE**)

Education Campus – Changa, (ECC), hitherto a conglomerate of institutes of professional education in Engineering, Pharmacy, Computer Applications, Management, Applied Sciences, Physiotherapy and Nursing, is one of the choicest destinations by students. It has been transformed into Charotar University of Science and Technology (CHARUSAT) through an Act by Government of Gujarat. CHARUSAT is permitted to grant degrees under Section-22 of UGC- Govt. of India.

The journey of CHARUSAT started in the year 2000, with only 240 Students, 4 Programmes, one Institute and an investment of about Rs. 3 Crores (INR 30 million). At present there are seven different institutes falling under ambit of six different faculties. The programmes offered by these faculties range from undergraduate (UG) to Ph.D degrees including M.Phil. These faculties, in all offer 23 different programmes. A quick glimpse in as under:

Faculty	Institute	Programmes Offered
Faculty of Technology & Engineering	Chandubhai S. Patel Institute of Technology	B. Tech M. Tech Ph. D
	Devang Patel Institute of Advance Technology and Research	B.Tech CE CSE IT
Faculty of Pharmacy	Ramanbhai Patel College of Pharmacy	B. Pharm M. Pharm Ph. D PGDCT/ PGDPT
Faculty of Management Studies	Indukaka Ipcowala Institute of Management	M.B.A PGDM Ph.D Dual Degree BBA+MBA
Faculty of Applied Sciences	P.D.Patel Institute of Applied Sciences	M.Sc M.Phil Ph.D Dual Degree B.Sc+M.Sc
Faculty of Computer	Smt. Chandaben Mohanbhai Patel Institute of	M.C.A/MCA

Faculty	Institute	Programmes Offered
Applications	Computer Applications	(Lateral) M.Sc IT Ph. D Dual Degree BCA+MCA
Faculty of Medical Sciences	Ashok and Rita Institute of Physiotherapy	B.PT M.PT Ph.D
	Manikaka Topawala Institute of Nursing	B.Sc M.Sc GNM
	Charotar Institute of Paramedical Sciences	Ph.D PGDHA

The development and growth of the institutes have already led to an investment of over Rs.63 Crores (INR 630 Million). The future outlay is planned with an estimate of Rs. 250 Crores (INR 2500 Million).

The University is characterized by state-of-the-art infrastructural facilities, innovative teaching methods and highly learned faculty members. The University Campus sprawls over 100 acres of land and is Wi-Fi enabled. It is also recognized as the Greenest Campus of Gujarat.

CHARUSAT is privileged to have 350 core faculty members, educated and trained in Stanford, IITs, IIMs and leading Indian Universities, and with long exposure to industry. It is also proud of its past students who are employed in prestigious national and multinational corporations.

From one college to the level of a forward-looking University, CHARUSAT has the vision of entering the club of premier Universities initially in the country and then globally. High Moral Values like Honesty, Integrity and Transparency which has been the foundation of ECC continues to anchor the functioning of CHARUSAT. Banking on the world class infrastructure and highly qualified and competent faculty, the University is expected to be catapulted into top 20 Universities in the coming five years. In order to align with the global requirements, the University has collaborated with internationally reputed organizations like Pennsylvania State University – USA, University at Alabama at Birmingham – USA, Northwick Park Institute –UK, ISRO, BARC, etc.

F Participatory and interactive discussion-based classes.

F Sessions by visiting faculty members drawn from leading academic institutions and industry.

F Regular weekly seminars.

F Distinguished lecture series.

F Practical, field-based projects and assignments.

F Summer training in leading organizations under faculty supervision in relevant programmes.

F Industrial tours and visits.

F Extensive use of technology for learning.

F Final Placement through campus interviews.

Exploration in the field of knowledge through research and development and comprehensive industrial linkages will be a hallmark of the University, which will mould the students for global assignments through technology-based knowledge and critical skills.

The evaluation of the student is based on grading system. A student has to pursue his/her programme with diligence for scoring a good Cumulative Grade Point Average (CGPA) and for succeeding in the chosen profession and life.

C CHARUSAT welcomes you for a Bright Future C

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

Faculty of Technology and Engineering

ACADEMIC REGULATIONS

Bachelor of Technology (CL/ ME/ EE) Programme

(Choice Based Credit System)

Charotar University of Science and Technology (CHARUSAT)
CHARUSAT Campus, At Post: Changa – 388421, Taluka: Petlad, District: Anand
Phone: 02697-247500, Fax: 02697-247100, Email: info@charusat.ac.in
www.charusat.ac.in

FACULTY OF TECHNOLOGY AND ENGINEERING

ACADEMIC REGULATIONS

Bachelor of Technology Programmes

Choice Based Credit System

To ensure uniform system of education, duration of undergraduate and post graduate programmes, eligibility criteria for and mode of admission, credit load requirement and its distribution between course and system of examination and other related aspects, following academic rules and regulations are recommended.

1) System of Education

Choice based Credit System with Semester pattern of education shall be followed across The Charotar University of Science and Technology (CHARUSAT) both at Undergraduate and Postgraduate levels. Each semester will have at least 90 working days duration. Every enrolled student will be required to take a course works in the chosen subject of specialization and also complete a project/dissertation if any. Apart from the Programme Core courses, provision for choosing University level electives and Programme/Institutional level electives are available under the Choice based credit system.

2) Duration of Programme

i)	Undergraduate programme	(B.Tech)
	Minimum	8 semesters (4 academic years)
	Maximum	16 semesters (8 academic years)

3) Eligibility for admissions

As enacted by Govt. of Gujarat from time to time.

4) Mode of admissions

As enacted by Govt. of Gujarat from time to time.

5) Programme structure and Credits

As per annexure – 1 attached

6) Attendance

6.1 All activities prescribed under these regulations and listed by the course faculty members in their respective course outlines are compulsory for all students pursuing the courses. No exemption will be given to any student from attendance except on account of serious personal illness or accident or family calamity that may genuinely prevent a student from attending a particular session or a few sessions. However, such unexpected absence from classes and other activities will be required to be condoned by the Dean/Principal.

6.2 Student attendance in a course should be 80%.

7) Course Evaluation

7.1 The performance of every student in each course will be evaluated as follows:

7.1.1 Internal evaluation by the course faculty member(s) based on continuous assessment. The continuous assessment will be conducted by the respective department/ institute.

7.1.2 Final end-semester examination by the University through written paper or practical test or oral test or presentation by the student or combination of these.

7.1.3 The weightages of continuous assessment and end-semester University examination in overall assessment shall depend on individual course as approved by Academic Council through Board of Studies.

7.1.4 The performance of candidate in continuous assessment and end-semester examination together (if applicable) shall be considered for deciding the final grade in a course.

7.1.5 In order to earn the credit in a course a student has to obtain grade other than FF.

7.2 Performance in continuous assessment and end-semester University Examinations

7.2.1 Minimum performance with respect to continuous assessment as well as end-semester university examination will be an important consideration for passing a course. Details of minimum percentage of marks to be obtained in the examinations are as follows:

Minimum percentage marks to be obtained in end-semester University examination (for applicable courses)	Minimum overall percentage marks to be obtained in each course
40%	45%

7.2.2 If a candidate obtains minimum required percentage of marks in end-semester University examination in an applicable course but fails to obtain minimum required overall percentage of marks, he/she has to repeat the examination till the minimum required overall percentage of marks are obtained.

8) Grade Point System

8. 1. The total of the internal evaluation marks and final University examination marks in each course will be converted to a letter grade on a ten-point scale as per the following scheme:

Table 1: Grading Point System (UG)

Range of Marks (%)	**≥80**	**≥73 <80**	**≥66 <73**	**≥60 <66**	**≥55 <60**	**≥50 <55**	**≥45 <50**	**<45**
Grade	AA	AB	BB	BC	CC	CD	DD	FF
Grade Point	10	09	08	07	06	05	04	00

8. 2. The student's performance in any semester will be assessed by the Semester Grade Point Average (SGPA). Similarly, his performance at the end of two or more consecutive semesters will be denoted by the Cumulative Grade Point Average (CGPA). The SGPA and CGPA are calculated as follows:

(i) SGPA = $\sum C_i G_i / \sum C_i$ where C_i is the number of credits of course i

G_i is the Grade Point for the course i

and i = 1 to n, n = number of courses in the semester

(ii) CGPA = $\sum C_i G_i / \sum C_i$ where C_i is the number of credits of course i

G_i is the Grade Point for the course i

and i = 1 to n, n = number of courses of all semesters up to which CGPA is computed.

9) Award of Class

- The class awarded to a student in the programme is decided by the final CGPA as per the following scheme:

Award of Class	CGPA Range
First Class with Distinction	CGPA ≥ 7.50
First class	7.49 > CGPA ≥ 6.00
Second Class	5.99 > CGPA ≥ 5.00
Pass Class	4.99 > CGPA ≥ 4.50

Grade sheets of only the final semester shall indicate the class. In case of all the other semesters, it will simply indicate as Pass / Fail.

9\. 1. Maximum duration allowed for Completion of a programme

- Maximum duration to allow for completion of a particular programme shall not be more than twice the normal duration of the respective programme. For example, a 6-Semester programme should be completed within not more than 12 semesters.

10) Detention Criteria

- No student will be allowed to move further in next semester if CGPA is less than 3 at the end of an academic year.
- A Student will not be allowed to move to third year if he/she has not cleared all the courses of first year.
- A student will not be allowed to move to fourth year if he/she has not cleared all the courses of first and second year.

11) Transcript

- A transcript issued to the student at the time of leaving the university will contain a consolidated record of all the courses taken by him / her, grades obtained and the final CGPA.

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
(CHARUSAT)

FACULTY OF TECHNOLOGY & ENGINEERING
(FTE)

CHOICE BASED CREDIT SYSTEM

FOR

BACHELOR OF TECHNOLOGY & ENGINEERING

CHOICE BASED CREDIT SYSTEM

With the aim of incorporating the various guidelines initiated by the University Grants Commission (UGC) to bring equality, efficiency and excellence in the Higher Education System, Choice Based Credit System (CBCS) has been adopted. CBCS offers wide range of choices to students in all semesters to choose the courses based on their aptitude and career objectives. It accelerates the teaching-learning process and provides flexibility to students to opt for the courses of their choice and / or undergo additional courses to strengthen their Knowledge, Skills and Attitude.

1. CBCS – Conceptual Definitions / Key Terms (Terminologies)

Types of Courses: The Programme Structure consist of 4 types of courses: Foundation courses, Core courses, Elective courses and Non-credit (audit) courses.

1.1. Foundation Course

These courses are offered by the institute in order to prepare students for studying courses to be offered at higher levels.

1.2. Core Courses

A Course which shall compulsorily be studied by a candidate to complete the requirements of a degree / diploma in a said programme of study is defined as a core course. Following core courses are incorporated in CBCS structure:

A. University Core courses(UC):

University core courses are compulsory courses which are offered across university and must be completed in order to meet the requirements of programme. Environmental science will be a compulsory University core for all Undergraduate Programmes.

B. Programme Core courses(PC):

Programme core courses are compulsory courses offered by respective programme owners, which must be completed in order to meet the requirements of programme.

1.3. Elective Courses

Generally, a course which can be chosen from a pool of courses and which may be very specific or specialised or advanced or supportive to the discipline of study or which provides an extended scope or which enables an exposure to some other discipline / domain or nurtures the candidates proficiency / skill is called an elective course. Following elective courses are incorporated in CBCS structure:

A. University Elective Courses(UE):

The pool of elective courses offered across all faculties / programmes. As a general guideline, Programme should incorporate 2 University Electives of 2 credits each (total 4 credits).

B. Institute Elective Course (IE)

Institute ekective courses are those courses which any students of the University/Institute of a Particular Level (PG/UG) will choose as offered or decided by the University/Institute from time-to-time irrespective of their Programme /Specialisation

C. Programme Elective Courses(PE):

The programme specific pool of elective courses offered by respective programme.

D. Cluster Elective Course (CE):

An ‘Elective Course’ is a course which students can choose from the given set of functional course/ Area or Streams of Specialization options (eg. Common Courses to EC/CE/IT/EE) as offered or decided by the Institute from time-to-time.

1.4. Non Credit Course (NC) - AUDIT Course

A ‘Non Credit Course’ is a course where students will receive Participation or Course Completion certificate. This will be reflected in Student’s Grade Sheet but the grade of the course will not be consider to calculate SGPA and CGPA. Attendance and Course Assessment is compulsory for Non Credit Courses.

1.5. Medium of Instruction

The Medium of Instruction will be English.

Annexure – 1

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY (Effective from 2018 Batch)												
TEACHING & EXAMINATION SCHEME FOR B TECH PROGRAMME IN (CIVIL/ELECTRICAL/MECHANICAL) ENGINEERING												
CHOICE BASED CREDIT SYSTEM												
Sem	Course Code	Course Title	Teaching Scheme				Examination Scheme				
			Contact Hours			Credit	Theory		Practical		Total
			Theory	Practical/ Tutorial	Total		Internal	External	Internal	External	
First Year Sem 1	HS101.01A-HS110.01A	A Course on Liberal Arts - (University Elective I)	2		2	2	00	00	30	70	100
	MA141	Engineering Mathematics-I	4	1	5	4	30	70	0	0	100
	ME141	Engineering Graphics	2	4	6	4	30	70	50	50	200
	PY141.01	Engineering Physics	3	2	5	4	30	70	25	25	150
	CL141	Engineering Mechanics	4	2	6	5	30	70	25	25	150
	ME142	Workshop Practices	0	2	2	1			25	25	50
		Assignment Practices /Student counselling /Remedial classes / Library/ Sports/ Extracurricular &co-curricular			10						
		Total	13	13	36	20	120	280	155	195	750
	HS126.01 A	Communication Skills – I	2		2	2	30	70	0	0	100
First Year Sem 2	MA142	Engineering Mathematics-II	4	1	4	4	30	70	0	0	100
	CL142	Environmental Sciences	2	0	2	2	30	70	0	0	100
	IT141	Fundamentals of Computer Programming	3	2	5	4	30	70	25	25	150
	ME143	Basics of Civil & Mechanical Engineering	4	2	6	5	30	70	25	25	150
	EE141	Basics of Electronics & Electrical Engineering	4	2	6	5	30	70	25	25	150
		Assignment Practices /Student counselling /Remedial classes / Library/ Sports/ Extracurricular &co-curricular			10						
		Total	17	09	36	22	180	420	75	75	750

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B. Tech. Programme

(Civil/ Mechanical/ Electrical Engineering)

SYLLABI

(Semester – 1)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF MANAGEMENT STUDIES
DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES
HS101.01A - HS110.01A: A COURSE FROM LIBERAL ARTS

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	-	2	-	2	2
Marks	-	100	-	100	

A. Objective of the Course:

To help learners to

1. Recognize the nature of aesthetic values and explore elements of arts and aesthetics with reference to personal, cultural and civic sphere
2. Connect art and aesthetics with Science and Technology to understand and extend research and innovation for a society

B. Courses:

Students may select any one course from the following:

Sr. No.	Title of the unit	Credits
1	Painting	02
2	Photography	
3	Sculpting	
4	Music	
5	Drama and Dramatics	
6	Yoga	
7	Dance	
8	Pottery and Ceramic Art	
9	Media and Graphics Design	

Total hours (Theory): 00
Total hours (Lab): 30
Total hours: 30

C. Instructional Method and Pedagogy:

- Teaching will be practical based on the hands on experiences, live and interactive Participation sessions. It may also run in the workshop mode.

D. Evaluation:

- The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 50 marks for internal evaluation and 50 marks for external evaluation.

Internal Evaluation

- Students' performance in the course will be evaluated on a continuous basis through the following components:

Sr No.	Component	Number	Marks Per Incidence	Total Marks
1		-	10	10
2	Performance/ Activities	-	10	10
3	Project	-	25	25
4	Attendance	-	05	05
			Total	50

External Evaluation

- University Practical examination will be for 50 marks and will test the performance, activities and creative presentations of the students with reference to the course selected:

Sr. No.	Component	Number	Marks Per Incidence	Total Marks
1	Viva/Practical	-	50	50
			Total	50

E. Student Learning Outcomes:

At the end of the course, students will have developed the ability to enjoy, interact with and perform arts and aesthetics; and will have developed the ability and creativity to transfer sense of design and innovation in science and technology.

HS101.01 A/B/C/D/E/F/G/H || PAINTING

I. Credits and Schemes

Sem	Course Code	Course Name	Credits	Teaching Scheme	Evaluation Scheme				
				Contact Hours/Week	Theory		Practical		Total
					Internal	External	Internal	External	
I	HS101.01 A/B/C/D /E/F/G/H	Painting	02	02	--	--	30	70	100

II. Course Objectives

- To encourage/ foster creativity among the students
- To introduce students to the fundamental processes of visual perception and artistic expression
- To cultivate / spawn awareness among students about the significance of art history, art criticism and aesthetics
- To help the students understand the meanings of concept, designs, shapes, colors, medium, and format
- To give the students the firsthand experience of design, painting, colors, light, shapes, shades and other important aspects of painting
- To develop in students an understanding of major styles and contemporary issues in painting

III. Course Outline

Module No.	Title/Topic	Classroom Contact Sessions
1	An Introduction to Painting • An Introduction to Painting • Principles of Composition • Medium and Techniques of Painting • History of Painting: Folk Indian Painting / Western Painting • 2D and 3D Painting	2
2	Drawing from Nature and Object • Objects of Drawing: Nature and Manmade / Artificial Objects • Drawing Still / Live Objects • Drawing from Memory • Drawing from Life	4
3	Colour Design and Colour Value • Color Theory: Color wheel (primary/secondary, complementary), transparency/opacity, hue, value (intensity, brightness),	6

	chroma (saturation, purity) & temperature (warm/cold) • Color Contrast & Attributes: Interaction, harmony, psychology/mood, culture & expression • Media Characteristics & Surfaces: Acrylic, oil, paper, wood & canvas (primed/unprimed)	
4	Composition and Perspective • Composition: Space, movement, balance, asymmetry, rhythm, shapes, proportion & lighting • Perspective: An approximate reproduction • Types of Perspectives: Linear Perspective, One-point Perspective, Two-point Perspective, Three-point Perspective, Four-Point Perspective	6
5	Figure Drawing and Proportion • Proportions of the Human Body • Three views – Anterior (front), Lateral (side) and Posterior (back) • Fundamental Proportion – The Big Three	4
6	Sketching • Sketching and Freehand • Sketching Techniques • Sketch and Drawing Medium	4
7	Contemporary Issues in Painting • Contemporary Indian Art • Pioneers of Contemporary Indian Art • Contemporary Issues in Painting	4
	Total Hours	30

IV. Instruction Method and Pedagogy

Teaching will be practical based on the hands on experiences, live and interactive sessions. It will run in the workshop mode. Four Workshops (each of a day) will be organised during the semester.

V. Evaluation

The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

VI. Internal Evaluation

Students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Participation	-	05	05

2	Performance/ Activities	-	05	05
3	Project	-	15	15
4	Attendance	-	05	05
			Total	30

VII. External Evaluation

University Practical examination will be for 70 marks and will test the performance, activities and creative presentations of the students with reference to the course selected:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Viva / Practical	-	70	70
			Total	70

VIII. Major Learning Outcomes

At the end of the course, a student will have cultivated a sense of creativity. Be appreciative of art history, art criticism and aesthetics. Be able to recognize the elements of arts in painting. Have better cognizance and association of meaning of colours, shapes, and composition. Be able to acknowledge the principles of painting as in design and colours, concept, medium and formats. Have instantaneous painting experience about designing, lights, shades and colours and such other important aspects.

HS102.01 A/B/C/D/E/F/G/H || PHOTOGRAPHY

I. Credits and Schemes

Sem	Course Code	Course Name	Credits	Teaching Scheme	Evaluation Scheme				
				Contact Hours/Week	Theory		Practical		Total
					Internal	External	Internal	External	
I	HS102.01 A/B/C/D/E/F/G/H	Photography	02	02	--	--	30	70	100

II. Course Objectives

- To introduce students to the tools and techniques of photography
- To provide students a thorough understanding of the mechanism and operations of a camera and help them understand the importance of aperture, shutter speed, film speed, depth of field, movement, and light meters to create a master shot
- To enable students to come out with a final project that demonstrates a single or a unified photographic idea or technique
- To explain students varied types of photographic representation including appropriation, persona, mixed media, non-objective images and engage them into experimentation using digital media
- To make students create a portfolio demonstrating creative uses of artificial and mixed lighting situations

III. Course Outline

Module No.	Title/Topic	Classroom Contact Sessions
1	An Introduction to Photography • Art, Design and Visualization • Basics of Photography and Various Types of Photography • Basics of Post Production • A Brief History of Photography: Early Experiments and Later Developments	03
2	Camera and Operating System • Role of Camera in the Photography • Types of Camera Pin-hole, box, folding, large and medium format cameras, single lens reflex (SLR) and twin lens reflex (TLR), miniature, subminiature and instant camera • Principal Parts of Photographic Camera Lens, Aperture, Shutters, various types and their functions, focal plane shutter and in-between the lens shutter, shutter synchronization, self-timer • Types of Lenses	05

	Single (meniscus), achromatic, symmetrical and unsymmetrical lenses, telephoto, zoom, macro, supplementary and fish-eye lenses • Different Models of Camera, their Features and Operating Systems • Camera and Size of the Image, Speed and Power of Lens	
3	Light and Shade • Reflection and refraction of light • Dispersion of light through a glass prism, lenses • Colour Filters: Different kinds, Red, yellow, green, neutral density, half filters, filter factor, colour correction filter • Photographic Light Sources: Natural source, the Sun, nature and intensity of the sunlight at different times of the day, different weather conditions • Artificial light sources: Nature, intensity of different types of light sources used in photography namely; (i) Photo flood lamp, (ii) Spot light, (iii) Halogen lamp, Barn doors and snoot, lighting stands • Flash unit: Bulb flash and Electronic flash, main components, electronic flash units, studio flash, slave unit, multiple flash, computer flash, x-contact, exposure table	10
4	Composition • Different kinds of image formations • Principal focus and focal length of the lens • Depth of field, angle of view and perspective • Perspective and composition • Rules of composition	09
5	Contemporary Issues in Photography • Present Day Photography • Contemporary Photographers and their Contributions • Major Issues in Contemporary Photography	03
	Total Hours	30

IV. Instruction Method and Pedagogy

Teaching will be practical based on the hands on experiences, live and interactive sessions. It will run in the workshop mode. Four Workshops (each of a day) will be organised during the semester.

V. Evaluation

The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

Internal Evaluation

Students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Participation	-	05	05
2	Performance/ Activities	-	05	05
3	Project	-	15	15
4	Attendance	-	05	05
			Total	30

External Evaluation

University Practical examination will be for 70 marks and will test the performance, activities and creative presentations of the students with reference to the course selected:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Viva / Practical	-	70	70
			Total	70

VI. Learning Outcomes

At the end of the course, students will be able to

- understand, appreciate and demonstrate innovative approach, beauty and acute acumen in the area of photography
- develop photography skills and become familiar with the functions and importance of the visual elements of nature and artificial objects
- become independent thinkers who will contribute inventively and critically to culture through the making of art photography
- have thorough understanding and acute sense of light and shade, composition, and presentation of a piece of an art
- experiment and represent the cultivated sense and skills in photography to the mass

HS103.01 A/B/C/D/E/F/G/H || SCULPTING

I. Credits and Schemes

Sem	Course Code	Course Name	Credits	Teaching Scheme	Evaluation Scheme				
				Contact Hours/Week	Theory		Practical		Total
					Internal	External	Internal	External	
I	HS103.01 A/B/C/D/E/F/G/H	Sculpting	02	02	--	--	30	70	100

II. Course Objectives

- To promote creativity and aesthetic sense pertaining to Sculpting by introducing them to the history of sculpting, its basic concepts and contemporary techniques and issues
- To help the students understand and develop the skill of sketching and drawing from life, natural and manmade objects and structures using various means like pencil, pen, ink, crayon, chalk, colour etc.
- To help them understand methods and materials of sculpture i.e. clay, plaster, cement, wood, stone, bronze, enlarging and reducing devises, welding torch etc.
- To help the students develop the sense of structure, and understand how forms achieve their structural unity through adherence to principles of physical nature of material being observed and studied (e.g. Plants, insects, minerals etc)
- To introduce the basic visual elements of 2-D and 3-D designs with emphasis on fundamentals of two and three-dimensional designs
- To acquaint the learners with various perspectives to draw and mould a sculpture
- To make the learners understand the colour theory and its practical usages
- To provide the students a sound background of the traditional and representational form in sculpture and enable them to develop their own vision

III. Course Outline

Module No.	Title/Topic	Classroom Contact Sessions
1	An Introduction to Sculpture • What Sculpture is and how it is different from other Arts • Basic elements, techniques, and history of sculpture • Form, Space and Basic Shapes in Sculpture • Casting materials, moldmaking, basic wood cutting and shaping, metal work, Welding, assembling, adhesives, plaster, mixing	06

2	Fundamental Principles of Sculpture • Basic Principles of Aesthetics in Sculpture • Visual Principles – balance, sequence, weight, and structural dynamics in sculpture • Structural Principles and communicative possibilities of sculpture	10
3	Process of Modeling • Additive and reductive processes • Major Techniques of Sculpture: Modeling, Carving, Pointing • Materials used in Modeling • Clay Modeling and Carving	11
4	Contemporary Issues in Sculpture • Sculpture and Present Day Context • Contemporary Sculptors and their Contribution • Major Contemporary Issues in Sculpture	03
	Total Hours	30

IV. Instruction Method and Pedagogy

Teaching will be practical based on the hands on experiences, live and interactive sessions. It will run in the workshop mode. Four Workshops (each of a day) will be organised during the semester.

V. Evaluation

The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

VI. Internal Evaluation

Students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Participation	-	05	05
2	Performance/ Activities	-	05	05
3	Project	-	15	15
4	Attendance	-	05	05
			Total	30

VII. External Evaluation

University Practical examination will be for 70 marks and will test the performance, activities and creative presentations of the students with reference to the course selected:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Viva / Practical	-	70	70
			Total	70

VIII. Learning Outcomes

Upon successful completion of this course, students will be able to:

- Incorporate basic principles of aesthetics into sculpture
- Understand and apply basic concepts, styles and latest techniques of sculpting
- Explore traditional and experimental materials and design for sculpture
- Maintain a sketchbook of ideas and drawings to work out art project and to document coursework and discussions
- Understand the latest jargons, and develop collaborative skills to exhilarate the speed of accomplishing the piece of art
- Make their portfolio rich by accomplishing projects given during course
- Become familiar with varied key sculptural techniques and formal ideas through hands-on workshops and experimentation with a variety of materials and three-dimensional assignments
- Present their work with greater impact and confidence for future prospects
- Get benefitted into other subjects of their study by developing broader and all-inclusive approach to learning

HS104.01 A/B/C/D/E/F/G/H || POTTERY AND CERAMIC ART

I. Credits and Schemes

Sem	Course Code	Course Name	Credits	Teaching Scheme	Evaluation Scheme				
				Contact Hours/Week	Theory		Practical		Total
					Internal	External	Internal	External	
I	HS104.01 A/B/C/D/E/F/G/H	Pottery and Ceramic Art	02	02	--	--	30	70	100

II. Course Objectives

- To encourage/ foster creativity among the students
- To introduce students to the craft of clay working
- To make the students able to create as well as appreciate expressive, beautiful three dimensional clay forms
- To recognize and realize the physical, emotional, and spiritual benefits of working with clay, and to except and come to terms with clays humbling qualities
- To build a higher-level understanding of the ceramic process, creating an awareness of the benefits of clay as a useful tool in their art therapy studies and practices
- To develop a deeper knowledge of the ceramic process, and become more confident with their hand building and glazing techniques
- To help them communicate an idea or emotion through their artwork

III. Course Outline

Module No.	Title/Topic	Classroom Contact Sessions
1	An Introduction to Clay • Elements and Materials of Ceramic Art and Shape • Prehistoric Cultures • Basics of Pinching, Slabbing and Coiling • Potter's wheel, centring the clay, forming bowls and cylinders • Trimming and burnishing on the wheel • Sketching the Pottery Models	5
2	Types and Techniques of Making Pottery • Types of Pottery: Porcelain Pottery, Earthenware Pottery, Stoneware Pottery • Techniques of Pottery: Hand-Built Pottery: Pinch, Coil, Slab Wheel-Thrown Pottery	7

3	Methods of Making Pottery • Coil Method • Pinch Method • Slab Method	8
4	Decorating the Clays • Different Methods of Decoration • Textures in Pottery • Colours, Painting, Carving, Glazing etc. in Pottery	7
5	Contemporary Issues in Pottery and Ceramic Art • Present Day Pottery and Ceramic Art • Place of Pottery and Ceramic Art in Contemporary Art Society • Major Practitioners of Contemporary Pottery and Ceramic Art and their Contributions	3
	Total Hours	30

IV. Instruction Method and Pedagogy

Teaching will be practical based on the hands on experiences, live and interactive sessions. It will run in the workshop mode. Four Workshops (each of a day) will be organised during the semester.

V. Evaluation

The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

VI. Internal Evaluation

Students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Participation	-	05	05
2	Performance/ Activities	-	05	05
3	Project	-	15	15
4	Attendance	-	05	05
	Total			30

VII. External Evaluation

University Practical examination will be for 70 marks and will test the performance, activities and creative presentations of the students with reference to the course selected:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Viva / Practical	-	70	70
			Total	70

VIII. Learning Outcomes

At the end of the course, the learners will

- have basic understanding of clay and glaze composition and formulation with emphasis on hand built ceramic forms.
- have explored a variety of hanbuilding methods including extended pinch, slab built and extruded forms
- have learned firing and glazing methods for stoneware clay
- have learned how finishing and decorating contribute or detract from the intention as an artist
- finally, a student will also have developed a sense of appreciation regarding how a unified, coherent form that is finely crafted is beautiful in its own right

HS105.01 A/B/C/D/E/F/G/H || MEDIA AND GRAPHIC DESIGN

I. Credits and Schemes

<table>
<tr><th rowspan="3">Sem</th><th rowspan="3">Course Code</th><th rowspan="3">Course Name</th><th rowspan="3">Credits</th><th>Teaching Scheme</th><th colspan="5">Evaluation Scheme</th></tr>
<tr><th rowspan="2">Contact Hours/Week</th><th colspan="2">Theory</th><th colspan="2">Practical</th><th rowspan="2">Total</th></tr>
<tr><th>Internal</th><th>External</th><th>Internal</th><th>External</th></tr>
<tr><td>I</td><td>HS105.01 A/B/C/D/E/F/G/H</td><td>Media and Graphic Design</td><td>02</td><td>02</td><td>--</td><td>--</td><td>30</td><td>70</td><td>100</td></tr>
</table>

II. Course Objectives

- To encourage/ foster creativity among the students
- To introduce students to the fundamentals of graphic designs
- To cultivate / spawn awareness among students about the significance of art and designs, art criticism and aesthetics
- To help the students understand the meanings of concept, designs, shapes, colors, print and medium
- To give the students first-hand experience of working on Graphic Software
- To develop in students an understanding of major issues, techniques and aspects of designs and print

III. Course Outline

Module No.	Title/Topic	Classroom Contact Sessions
1	An Introduction to Media and Graphic Design • Creating Art, Art in Context and Art as Inquiry • History of Graphic Design • Constructional, Representational, and Simplification Drawing	03
2	Layout and Design • Layout, Design and Aesthetics • Elements of Design • Principles of Design: Harmony, Balance, Rhythm, Perspective, Emphasis, Orientation, Repetition and Proportion • Impact/function of Design • Indigenous design practices • Role of design in the changing social scenario	07
3	Form and Space • Types of Forms: Man-made, Nature • Types of Space: Negative and Positive • Composition of Form and Space to create Layout • Exploring Creativity	06

4	Computer Graphics • An Introduction to Graphic Software • Flash, Coreldraw, Illustrator and Photoshop • Pre-press Process	04
5	Fonts • Construction of Type • Anatomy of Type • Visual Language • Creating Logo and Symbol	04
6	Basic Print Media • An Introduction to Press and its Development Phases • Types of Press • Types of Printing Technologies • Post-press Processes	03
7	Contemporary Issues in Graphic Design • Present Day Graphic Designs • Contemporary Designers and their Contribution • Major Contemporary Issues in Graphic Design	03
	Total Hours	30

IV. Instruction Method and Pedagogy

Teaching will be practical based on the hands on experiences, live and interactive sessions. It will run in the workshop mode. Four Workshops (each of a day) will be organised during the semester.

V. Evaluation

The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

VI. Internal Evaluation

Students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Participation	-	05	05
2	Performance/ Activities	-	05	05
3	Project	-	15	15
4	Attendance	-	05	05
	Total			30

VII. External Evaluation

University Practical examination will be for 70 marks and will test the performance, activities and creative presentations of the students with reference to the course selected:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Viva / Practical	-	70	70
			Total	70

VIII. Learning Outcomes

At the end of the course, a student will

- have cultivated a sense of creativity.
- be appreciative of art and designs, art criticism and aesthetics.
- be able to recognize the elements of arts in graphic design.
- have better cognizance and association with the meaning of designs, shapes, colors, print and medium.
- be able to design graphics using computer softwares like photoshop, coreldraw, and illustrator.

HS106.01 A/B/C/D/E/F/G/H || ART AND CRAFT

I. Credits and Schemes

Sem	Course Code	Course Name	Credits	Teaching Scheme	Evaluation Scheme				
				Contact Hours/Week	Theory		Practical		Total
					Internal	External	Internal	External	
I	HS106.01 A/B/C/D/E/F/G/H	Art and Craft	02	02	--	--	30	70	100

II. Course Objectives

- To encourage / foster creativity among the students
- To enable the students to work through the process of bringing an idea from conception to realization
- To enable students to create artifacts that are visually expressive
- To cultivate / spawn awareness among students about the significance of art, craft and aesthetics
- To develop students' graphic skills which may work towards the realization of ideas in the creation of 2D and 3D
- To provide opportunities to students to be conversant with the use of a variety of materials, media, tools and equipments for Art and Craft

III. Course Outline

Module No.	Title/Topic	Classroom Contact Sessions
1	An Introduction to Art and Craft • Basic Design and Forms • Space and Geometry • Elements of Nature and Object	03
2	Paper Cutting • Study of Designs • Context of Space and Form • Types of Textures and Papers • Principles of Paper Cutting	05
3	Design from Nature • Nature as a Source of Design • Principles of Designing Natural Object • Decorative Forms • Cutting, Collaging, Embossing and Itching	08
4	Card Board Modeling • Principles of Form and Space • Dimensions of Space and Shape • Process of Modeling and Decoration	06
5	Print Making • An Introduction to Print Making • A Brief History of Print Making • Types of Print Making	05

- Processing of Print Making
- Sketching and Drawing

6	Contemporary Issues in Art and Craft • Present-day Art and Craft • Using the Waste for making the Best • Contemporary Issues in Art and Craft	03
	Total Hours	30

IV. Instruction Method and Pedagogy

Teaching will be practical - based on the hands on experiences, live and interactive sessions. It will run in the workshop mode. Four Workshops (each of a day) will be organised during the semester.

V. Evaluation

The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

VI. Internal Evaluation

Students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Participation	-	05	05
2	Performance/ Activities	-	05	05
3	Project	-	10	10
4	Attendance	-	05	05
			Total	30

VII. External Evaluation

University Practical examination will be for 70 marks and will test the performance, activities and creative presentations of the students with reference to the course selected:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Viva / Practical	-	70	70
			Total	70

VIII. Learning Outcomes

At the end of the course, students will

- be aware about the significance of art, craft and aesthetics.
- able to create artefacts that are visually expressive.
- able to lead the ideas from conceptualization with reference to the 2d and 3d model making.
- conversant with the use of a variety of materials, media, tools and equipment's for creative art and craft.

HS107.01 A/B/C/D/E/F/G/H || FASHION DESIGNING

I. Credits and Schemes

Sem	Course Code	Course Name	Credits	Teaching Scheme	Evaluation Scheme				
				Contact Hours/ Week	Theory		Practical		Total
					Internal	External	Internal	External	
1	HS 107.01 A/B/C/D/E /F/G/H	Fashion Designing	02	02	--	--	30	70	100

II. Course Objectives

- to help students learn the basics of fashion designing
- to make them aware about foundations of both - construction and graphic skills and strategies necessary for fashion designing
- to make students aware about the elements of the design process, from sketch to finish
- to acquaint students with consumer trends for fashion designing
- to enable the student to identify and anticipate changes in lifestyles, consumers' preferences, as well as current and emerging trends, through creative experimentation and research

III. Course Outline

Module No.	Title / Topic	Classroom Contact Sessions
1.	An Introduction Fashion Designing • Introduction to the Fashion Designing: Definition, Concept and Importance • Evolution of Fashion: History of Fashion Industry and its Growth & Development • Four levels of Fashion : Primary, Secondary, the Retail and Auxiliary level	04
2.	Nature of Fashion and Fashion Design • Terminology of Fashion and Designs • Principles of Fashion Movement • Fashion Cycles	04
3.	Environment of Fashion • Market Segmentation Demographics, Geographic, Psychographics & Behavioural • Economic Environment	06

	• Social Environment	
4.	Elements and Principles of Design • Study of Colour: Colour Wheel, Schemes • Colour Theory & Visual Effects • Study of Texture & Fabric: Types and Categories • Psychology and Visual Association	06
5.	Fashion Designing and Production • Aesthetic qualities of Design Elements: Formal qualities, Expressive qualities, Symbolic qualities • Principles of Design: Gradation, Balance, Harmony, Emphasis, Rhythm • Design Sketching • Construction Techniques	04
6.	Contemporary Issues and Challenges • Cross cultural issues in Fashion Industry • Study of Contemporary Fashion Designers • Trend Analysis in Fashion Industry • Creative Contexts and Fashion Designing • Branding and Intellectual Property	06
	Total Hours	30

IV. Instruction Method and Pedagogy

Teaching will be practical based on the hands on experiences, live and interactive sessions. It will run in the workshop mode. Four Workshops (each of a day) will be organised during the semester.

V. Evaluation

The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

Internal Evaluation

Students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per Incidence	Total Marks
1.	Participation	-	05	05
2.	Performance/ Activities	-	05	05
3.	Project	-	15	15
4.	Attendance	-	05	05

	Total	30

External Evaluation

University Practical examination will be for 70 marks and will test the performance, activities and creative presentations of the students with reference to the course selected:

Sl. No.	Component	Number	Marks per Indices	Total Marks
1	Viva/ Practical	-	70	70
Total				70

VI. Major Learning Outcomes

At the end of the course, a student will

1. be aware with origin and development of fashion designing industry.
2. have cultivated a sense of creativity.
3. be able to recognize the elements of fashion and design.
4. be able to acknowledge the principles of fashion as in colours, textures, shapes etc.
5. demonstrate knowledge in fashion, patterns, and the basic theories of fashion design.
6. be able to use industry terminology and equipment in appropriate ways.
7. be able to analyse and use colour units effectively in their design process.
8. have in depth understanding of pattern making, illustration, and construction of garments.
9. demonstrate proficiency in examining trends, drawing designs based on their ideas, choosing colours and fabrics, and supervising the production of their designs.

HS108.01 A/B/C/D/E/F/G/H || INTERIOR DESIGNING

I. Credits and Schemes

<table>
<tr><th rowspan="3">Sem</th><th rowspan="3">Course Code</th><th rowspan="3">Course Name</th><th rowspan="3">Credits</th><th>Teaching Scheme</th><th colspan="5">Evaluation Scheme</th></tr>
<tr><th rowspan="2">Contact Hours</th><th colspan="2">Theory</th><th colspan="2">Practical</th><th rowspan="2">Total</th></tr>
<tr><th>Internal</th><th>External</th><th>Internal</th><th>External</th></tr>
<tr><td>I</td><td>HS108.01 A/B/C/D/ E/F/G/H</td><td>Interior Designing</td><td>02</td><td>02</td><td>--</td><td>--</td><td>30</td><td>70</td><td>100</td></tr>
</table>

II. Course Objectives

- To encourage / foster sense of creativity or innovativeness among the students
- To introduce students to the principles of designs
- To cultivate various theories of perceptions among students
- To help the students to develop Drawing skills as tools for Design thinking and expression.
- To expose students to various materials used in construction for different elements of building.
- To develop in students an understanding of colour as an integral part of creation
- To understand technical and constructional aspects of interior spaces, the methodologies of elaborating the concept of a project and its appropriate representation.
- To help students understand qualities of interior - texture, colour, light, scale and proportion

III. Course Outline

Module No.	Title / Topic	Classroom Contact Sessions
1.	INTRODUCTION TO INTERIOR DESIGNING • Concept and Meaning of Interior Designing • Understanding principles of designs • Understanding of elements of visual perception • Evolution of forms and Relationship among the forms • Analysis of visual impression of forms through line, plane and solids, and their integration • Perception of forms through movement in space • Scale and Human Perception • Observation and Recording through Drawing – Pencil, pen, brush, Charcoal Crayons, etc.	6
2.	PRINCIPLES OF DRAWINGS • Introduction to Drawing terms • Familiarizations with drawings materials and equipment • Point and line, straight and curvilinear lines, lettering • Line Intensity, sharpness and gradation for presentation • Principles of plane geometry, scale, orthographic • Sections of solids – simple & complex	6

	• Development of surfaces of solids	
3.	UNDERLYING PRINCIPLES OF CONSTRUCTION • Introduction to materials • Types of interior material • Visual quality of materials • Parameters for material selection • Elements of Building • Basic elements of structure and their behaviour	6
4.	BEHAVIOURAL SCIENCE AND INTERIOR DESIGNING • Essential elements of Society: Bio-socio-cultural societies • Characteristics of human society • Colour psychology and interior designing • Personal space and territoriality, Furnishing and Furniture • Commercial Environment, Offices - behaviour in work places • Construction drawing system and methods	6
5.	CONTEMPORARY PRACTICES IN INTERIOR DESIGN • Current practices in interior designing in various social settings • Ongoing research or innovation in the field of interior designing • Prevalent and Proposed trends in interior designing	4

IV. Instruction Method and Pedagogy

Teaching will be practical based on the hands on experiences, live and interactive sessions. It will run in the workshop mode. Four Workshops (each of a day) will be organized during the semester.

V. Evaluation

The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

Internal Evaluation

Students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Participation	-	05	05
2	Performance/ Activities	-	05	05
3	Project	-	15	15
4	Attendance	-	05	05
Total				30

External Evaluation

University Practical examination will be for 70 marks and will test the performance, activities and creative presentations of the students with reference to the course selected:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Viva / Practical	-	70	70
Total				70

VI. Major Learning Outcomes

At the end of the course, the students will:

- be aware with the history and development of field of interior design.
- have cultivated a sense of creativity.
- be able to recognize the design elements for interior designing.
- have better cognizance and association of meaning of colors, shapes, light, scale and proportion.
- have instantaneous interior designing experience about designing, lights, shades and colors and such other important aspects.
- be able to develop an interior design project on a minor scale.

HS109.01 A/B/C/D/E/F/G/H || DRAMATICS

I. Credits and Schemes

<table>
<tr><th rowspan="3">Sem.</th><th rowspan="3">Course Code</th><th rowspan="3">Course Name</th><th rowspan="3">Credits</th><th>Teaching Scheme</th><th colspan="5">Evaluation Scheme</th></tr>
<tr><th rowspan="2">Contact Hours / Week</th><th colspan="2">Theory</th><th colspan="2">Practical</th><th rowspan="2">Total</th></tr>
<tr><th>Internal</th><th>External</th><th>Internal</th><th>External</th></tr>
<tr><td>I</td><td>HS109.01 A/B/C/D/E /F/G/H</td><td>Dramatics</td><td>02</td><td>02</td><td>--</td><td>--</td><td>30</td><td>70</td><td>100</td></tr>
</table>

II. Course Objectives:

- To acquaint students with the concept of performing arts
- To teach professional acting skills to the students
- To offer training in the key areas of performance
- To acquaint students with the history, theory, and aesthetic value of theatre
- To provide students extensive training in acting skills (monologues, dialogues, and group scenes from a variety of sources), dance, voice, theatre production, and rehearsal techniques, which culminates in a performance before a live audience

III. Couse Outline

Module	TITLE / TOPIC	Classroom Contact Sessions
1	Introduction to Drama • Introduction to performing arts • Drama - An art, a socializing activity, & a way of learning • Form of Drama • Elements of Drama • Types of Drama	06
2	History of Drama and Contemporary Theatre • Important world dramatists & drama–from Greek to modern • Evolution of contemporary theatre in the context of developments in Indian theatre • Major Movements in Drama	06
3	Theatre Design and Techniques • Theatre Architecture • Stage craft: Set, light, costume, make up, sound, props • Theatre techniques: from selection of script to final performance	06

4	Technicalities of Stage Performance • Selection of plot and character • Improvisation • Movement • Voice, Speech, Imagination • Character Development • Scene Enactment	08
5	Contemporary Trends in Drama • New Tendencies in theatre • Drama and Society • Using drama for Social Change and Education	04

IV. Instruction Method and Pedagogy

Teaching will be practical based on the hands on experiences, live and interactive sessions. It will run in the workshop mode. Four Workshops (each of a day) will be organised during the semester.

V. Evaluation

The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

Internal Evaluation:

Students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Participation	-	05	05
2	Performance/ Activities	-	05	05
3	Project	-	15	15
4	Attendance	-	05	05
Total				30

External Evaluation

University Practical examination will be for 70 marks and will test the performance, activities and creative presentations of the students with reference to the course selected:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Viva / Practical	-	70	70
Total				70

VI. Major Learning Outcomes

At the end of the course, a student will

- be aware about the concept of performing art and its nuances.
- display a working knowledge of historic of drama, its development and current trends in dramatics.
- demonstrate skills in the technical/design preparation and execution of a theatre performance.
- demonstrate the ability to work collaboratively.
- develop essential transferable skills in various relevant areas of the theatre.

HS110.01 A/B/C/D/E/F/G/H || CONTEMPORARY DANCE

I. Credits and Schemes

Sem	Course Code	Course Name	Credits	Teaching Scheme	Evaluation Scheme				
				Contact Hours/Week	Theory		Practical		Total
					Internal	External	Internal	External	
1	HS110.01 A/B/C/D/E/F/G/H	Contemporary Dance	02	02	--	--	30	70	100

II. Course Objectives

- To introduce students to the concept of performing arts
- To develop in students the ability to express through the form of dance
- To foster creativity and innovativeness in students
- To enhance the aesthetic sensitivity among the students
- To inculcate in students contemporary dance techniques, philosophies, approaches, improvisation and performance disciplines
- To help students improve concentration, mental alertness, quick reflex action, physical agility and stress relief capacities
- To provide the students with complete awareness of one's own body
- To guide the students express themselves a natural way human feelings and expressions by creating harmony

III. Course Outline

Module No.	Title / Topic	Classroom Contact Sessions
1.	Introduction to dance • Dance as a Performing Art • Dance as a Medium of Expression • History and Development of Dance	4
2.	Types of Dance • Western dance and classical dance • Salsa, rumba, hip hop, tap dance, belly dance, etc. • Indian Classical Dance forms: Odissi, Bharatanatyama, Kathak, Kathakali, Kuchipudi etc. • Other Regional dance forms in India	6
3.	Basic Elements of Dance • Movements of different parts of a body for Expression • Concepts of: Nritya, Laya and Taal	4
4.	Technical Skills in Professional Contemporary Dance • Dance technique: alignment, balance, co-ordination, flexibility and control • Expressive / presentation skills: Dynamic energy, physical engagement with the given material and stage, etc. • Skills and processes of rehearsal and production:	6

	physical energy, stamina and athleticism • Musicality: clarity of timing and phrasing	
5.	Contemporary Trends in Dance : • Prevalent trends and techniques in contemporary dance • Future trends in contemporary dance form • On Stage Performance	10
	Total Hours	30

IV. Instruction Method and Pedagogy

Teaching will be practical based on the hands on experiences, live and interactive sessions. It will run in the workshop mode. Four Workshops (each of a day) will be organised during the semester.

V. Evaluation

The students will be evaluated continuously in the form of their consistent performance throughout the semester. There is no theoretical evaluation. There is just practical evaluation. The evaluation (practical) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation.

Internal Evaluation

Students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Participation	-	05	05
2	Performance/ Activities	-	05	05
3	Project	-	15	15
4	Attendance	-	05	05
			Total	30

External Evaluation

University Practical examination will be for 70 marks and will test the performance, activities and creative presentations of the students with reference to the course selected:

Sr. No	Component	Number	Marks per incidence	Total Marks
1	Viva / Practical	-	70	70
			Total	70

VI. Major Learning Outcomes

At the end of the course, a student will

- be able to develop ability to express through the form of dance.
- have enhanced aesthetic sensitivity.
- have improved concentration, mental alertness, quick reflex action, and physical agility.
- be able to express a natural way human feelings and expressions by creating harmony.
- be able to deliver contemporary dance performance.

FACULTY OF APPLIED SCIENCES
DEPARTMENT OF MATHEMATICAL SCIENCES

MA141: ENGINEERING MATHEMATICS – I

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	4	0	1	5	4
Marks	100	0	-	100	

A. Objective of the Course:

A good Engineer has to have an excellent background of Mathematics. Engineering Mathematics is one of the essential tools for learning Technology, Engineering and Sciences. This course lays the foundation for engineering Mathematics in subsequent semesters, so that students get a sound knowledge and important aspects of the course. The objectives of the course are to:

- Understand applications of differentiation in respective Engineering Branch
- Understand basics of Matrix Algebra and methods to solve problems
- Understand complex numbers, their properties and applications to Engineering problems
- Understand solution to algebraic equations
- Understand the sequence and series, conditions for convergence and divergence

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Higher order derivatives and applications	09
2.	Partial differentiation	10
3.	Applications of Partial differentiation	09
4.	Matrix Algebra –I	10

5.	Algebra of Complex numbers and Roots of polynomial Equations	12
6.	Infinite Series	10

Total hours (Theory): 60

Total hours (Lab): 00

Total hours: 75

C. Detailed Syllabus:

1 Higher order derivatives and applications 09 Hours 15%

1.1 Set theory and Function

1.2 Limit, Continuity, Differentiability for function of single variable and its uses.

1.3 Successive differentiation: n^{th} derivative of elementary functions viz., rational, logarithmic, trigonometric, exponential and hyperbolic etc.

1.4 Leibnitz rule for the n^{th} order derivatives of product of two functions

1.5 Expansion of Functions: Maclaurin's & Taylor's series expansion

1.6 L'Hospital's rule and related applications, Indeterminate forms.

2 Partial differentiation 10 Hours 17%

2.1 Partial derivative and geometrical interpretation

2.2 Euler's theorem with corollaries and their applications

2.3 Chain rule

2.4 Implicit differentiation

2.5 Total differentials.

3. Applications of Partial differentiation 09 Hours 15%

3.1 Tangent plane and normal line to a surface

3.2 Maxima and Minima

3.3 Langrage's method of multiplier

3.4 Jacobian

3.5 Errors and approximations

4.	Matrix Algebra- I:	10 Hours	17%
4.1	Definition of Matrix, types of matrices and their properties		
4.2	Determinant and their properties		
4.3	Rank and nullity of a matrix		
4.4	Determination of rank		
4.5	Gauss Jordan method for computing inverse, Triangularization of Matrices by Gauss Elimination Process		
4.6	Solution of system of linear equations		
5	Algebra of Complex numbers and Roots of polynomial Equations	12 Hours	19%
5.1	Complex numbers & their geometric representation		
5.2	Complex numbers in polar and exponential forms		
5.3	Demoirve's theorem and its applications		
5.4	Exponential, Logarithmic, Trigonometric and hyperbolic functions.		
5.5	Statement of fundamental theorem of Algebra, Analytical solution of cubic equation by Cardan's method		
5.6	Analytic solution of Biquadratic equations by Ferrari's method with their applications.		
6.	Infinite Series	10 Hours	17%
6.1	Introduction to sequence and series		
6.2	convergence and divergence of infinite series		
6.3	necessary condition for convergence		
6.4	Geometric series		
6.5	Tests of convergence viz., comparison test, p-series test, ratio test, n^{th} root test, Leibnitz test, integral test and power series.		
6.6	Convergence of Taylor's and Maclaurian Series		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

- Attendance is compulsory in lectures/laboratory which carries a 5% component of the overall evaluation.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weighting of 5%.
- Two Quizzes (surprise test) will be conducted which carries 5% component of the overall evaluation.

E. Student Learning Outcomes:

- At the end of the course the students will be able to understand the basic concepts of Engineering Mathematics.
- Student will be able apply concepts of these course to learn MA 142: Engineering Mathematics-II and may be some courses other then Mathematics.
- Students will be able to apply the mathematical concepts in other engineering courses.

F. Recommended Study Material:

- Text Books:
    1. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Ed., Jhon Wiley & Sons, India, 1999
- Reference Books:
    1. M.D. Wier, et. al., Thomas' Calculus, 11th Ed., Pearson Education, 2008
    2. Stewart James, Calculus Early Transcendental, 5th Ed., Thomson India, 2007
    3. Wylie & Barrett, Advanced Engineering Mathematics, Mc graw Hill pub.
    4. Greenberg, M.D., Advanced Engineering Mathematics, 2nd ed., Pearson
- Web Materials:
    1. http://mathworld.wolfram.com/
    2. http://en.wikipedia.org/wiki/Math

ME 141: ENGINEERING GRAPHICS

Credit and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	2	4	-	6	4
Marks	100	100	-	200	

A. Objective of the Course:

This course covers fundamentals of the engineering drawing for first year engineering students. The objective of the course are to:

1. Introduce the universal language and tool of communication for engineers.
2. Develop visualization of the three-dimensional engineering components.
3. Understand and apply the concepts, elements and grammar of engineering drawing.
4. Introduce the computer aided drafting.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Fundamentals of Engineering Graphics	08
2.	Projections of Points and Lines	06
3.	Projections of Planes	06
4.	Projections & Section of Solid	06
5.	Orthographic Projection*	06
6.	Isometric Projections*	06
7.	Computer Aided Drafting*	04
8.	Development of Lateral Surfaces	04

* indicates the topics are covered in laboratory

Total hours (Theory): 30

Total hours (Practical): 60

Total hours: 90

C. Detailed Syllabus:

1.	Fundamentals of Engineering Drawing	08 Hours	14%
1.1	Importance of engineering drawing, drawing instruments and materials, BIS and ISO		
1.2	Different types of lines used in engineering practice, methods of projections as per SP 46-1988.		
1.3	Engineering Scale.		
1.4	Engineering Curve.		
2.	Projections of Points and Lines	06 Hours	14%
2.1	Introduction to methods of projections		
2.2	Projections of lines inclined to both the planes		
3.	Projections of Planes	06 Hours	14%
3.1	Projection of plane		
3.2	Auxiliary Projection Method		
4.	Projections & Section of Solid	06 Hours	14%
4.1	Projection of solids		
4.2	Sectional view		
4.3	True shape of Sections		
4.4	Auxiliary Inclined Plane (AIP), Auxiliary Vertical Plane (AVP)		
5.	Orthographic Projection	06 Hours	14%
5.1	Principle projection		
5.2	Methods of first and third angle projection with examples / problems		
6.	Isometric Projections	06 Hours	14%
6.1	Terminology, Isometric scale		
6.2	Isometric view and Isometric projection with examples / problems		
7.	Computer Aided Drafting	04 Hours	8%
7.1	Introduction to 2D drafting facilities in CAD software - AutoCAD.		
8.	Development of Lateral Surfaces	04 Hours	8%
8.1	Method of Development		
8.2	Developments of cylinder, cone, prism, pyramid		

D. Instructional Methods and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of Multi-Media projector, Black Board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Drawing sheets/Tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Student Learning Outcomes:

On the completion of the course one should be able to:

1. Understand and interpret various engineering drawings.
2. Learn the concept, application and be able to draw engineering scale and engineering curve.
3. Learn three-dimensional visualization of engineering components through orthographic, sectional orthographic and isometric drawing.
4. Understand the concept, application and be able to draw projection of point and projection of line.
5. Learn the concept, application and be able to draw projection of plane, projection & section of solid and development of lateral surfaces.
6. Learn the overview of computer aided drafting.

F Recommended Study Material:

Text Books:

1. N. D. Bhatt & V. M. Panchal, “Engineering Drawing”, Charotar Publishing House Pvt. Ltd.
2. P. J. Shah, “Engineering Graphics”, S. Chand Publishing & Co.

Reference Books:

1. P.B. Patel & P.D. Patel, “Engineering Graphics”, Mahajan Publishing House.
2. Arunoday Kumar, “Engineering Graphics”, Tech-Max Publication.

3. Gopal Krishna K.L., “Engineering Drawing”, Subhas Publications
4. Venugopal, K., “Engineering Drawing made Easy”, Wiley Eastern Ltd.
5. M.L. Agrawal & R.K. Garg, “Engineering Drawing”, Vol. I, Dhanpatrai & Co.
6. T.E. French, C.J. Vierck & R. J. Foster, “Graphic Science and Design”, McGraw Hill.
7. W. J. Luzadder & J. M. Duff, “Fundamentals of Engineering Drawing”, Prentice Hall.
8. K. Venugopal, “Engineering Drawing and Graphics”, New Age international Pry. Ltd.

Reading Materials, web materials with full citations:

1. http://nptel.ac.in/courses/112103019/
2. http://www.slideshare.net/search/slideshow?searchfrom=header&q=engineering+drawing
3. http://www.engineering108.com/pages/Engineering_graphics/Engineering_graphics_tutorials_free_download.html
4. https://law.resource.org/pub/in/bis/S01/is.sp.46.2003.pdf

FACULTY OF APPLIED SCIENCES
DEPARTMENT OF PHYSICS

PY141.01: ENGINEERING PHYSICS

Credit and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	3	2	-	5	4
Marks	100	50	-	150	

A. Objective of the Course:

The main objective to give the course of Engineering Physics is

- To study the basic concepts of physics and engineering applications of physics.
- To develop physical intuition, mathematical reasoning, and problem solving skills.
- To prepare students for the necessarily rigorous sequence in physics and engineering.
- To develop an ability to identify, formulate and solve physics and engineering problem through numerical analysis and laboratory methods.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Error Analysis	05
2.	Introduction to Quantum Mechanics	08
3.	Acoustics and Ultrasonics	08
4.	Physics of Laser and its applications	09
5.	Condensed Matter and Material Physics	10
6.	Nanoscience	05

Total hours (Theory): 45
Total hours (Practical): 30
Total hours: 75

C. Detailed Syllabus:

1. Error Analysis:	05 hours	11%

1.1 Uncertainties in Measurements: Sources and estimation of errors, accuracy and precision, systematic error, random error, Significant figure and round off

1.2 Uncertainties, Parent and Sample Distributions, Mean and Standard Deviation of Distributions

1.3 Average error, r.m.s error, probable error and error propagation

1.4 Introduction to regression analysis and its uses

1.5 Applications with numericals

2. Introduction to Quantum Mechanics:	08 hours	18%

2.1 Origin of quantum mechanics

2.2 Dual nature of matter, concept of wave group, Davisson and Germer experiment

2.3 Heisenberg's uncertainty principle and its applications, Schrodinger's wave equation

2.4 Interpretation of wave equation and wave function

2.5 Applications of Schrodinger's wave equation

3. Acoustics and Ultrasonics:	08 hours	18%

3.1 Introduction to waves

3.2 Characteristics of Sound waves

3.3 Architectural Acoustics, Absorption Coefficient, Reverberation, Sabine's formula, Factors affecting acoustics of buildings and their remedies

3.4 Ultrasonics: Introduction and properties

3.5 Production: piezoelectric and magnetostriction method

3.6 Detection of Ultrasonic waves

3.7 Applications with numericals

4. Physics of Laser and its applications:	09 hours	20%

4.1 Lasers and its properties, Spontaneous and stimulated emission

4.2 Einstein coefficients

4.3 Gas laser (He-Ne Laser), Semiconductor Laser, Applications of Laser

4.4 Basic Principle of Holography, Construction and reconstruction of hologram, Applications of Holography

4.5 Introduction to optical fibre, Numerical Aperture of optical fibre

4.6 Types of optical fibre, applications of optical fibre

5. Condensed Matter and Material Physics:	10 hours	22%

5.1 Basics of Crystal structure

5.2 X – Ray: properties, production, applications of X – Rays

5.3 Conductors, Insulators and Semiconductors: Band theory of Solids

5.4 Energy gap, Fermi energy, Electrical conductivity and mobility

5.5 Hall effect

5.6 Introduction to magnetic materials

5.7 Basics of superconductivity and its applications

6. Nanoscience: 05 hours 11%

6.1 Introduction to nanomaterials

6.2 0D, 1D, 2D nanostructures

6.3 Bottom-up and Top-down approach to synthesis of nanomaterials

6.4 Structural characterization by XRD and SEM

6.5 Applications of nanomaterials

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory which carries 10 Marks weightage.
- Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.
- Assignment/Surprise tests/Quizzes/Seminar will be conducted which carries 5 Marks as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Student Learning Outcomes:

On the successful completion of the course:

1. The student would be able to apply the concepts of physics in various branches of engineering.
2. An ability to identify, formulate and solve engineering problems.

3. An ability to use the techniques, skills and modern tools of physics necessary for engineering applications.
4. An ability to design and conduct experiments, analyze and interpret data.

F. Recommended Study Material:

- Text Books:
  1. Vijayakumari, G., Engg. Physics, Vikas Publishing house Pvt. Ltd.
  2. Rajagopal, K., Engg. Physics, Prentice Hall of India Pvt. Ltd.
  3. Avadhalula, M. N. & Kshirsagar, P. G., A text book of Engg. Physics, S. Chand Pub.
- Reference Books:
  1. Nayak Abhijit, Engg. Physics, S. K. Kataria and Sons Pub.
  2. Topping, J., Errors of Observations and their Treatment, 3rd Ed. Chapman and Hall ltd. London
  3. Kittle, C., Solid State Physics
  4. Resnick and Haliday, Physics Part-I & II, Wiley Eastern publication
  5. Beiser Arthur, Concept of Modern Physics
  6. Ghatak, Optics, Tata McGraw Hill, 3rd Edition
  7. Pillai, S.O., Solid State Physics, Wiley Eastern Ltd.
- Web Materials:
  1. http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Guwahati/engg_physics/index_cont.htm
  2. http://ncert.nic.in/html/learning_basket.htm
  3. http://science.howstuffworks.com/laser1.htm
  4. http://physics-animations.com/Physics/English/optics.htm
  5. http://physics-animations.com/Physics/English/waves.htm
  6. http://www.epsrc.ac.uk
  7. http://www.pitt.edu/~poole/physics.html#light
  8. http://de.physnet.net/PhysNet/optics.html

FACULTY OF TECHNOLOGY & ENGINEERING
MANUBHAI SHIVABHAI PATEL DEPARTMENT OF CIVIL ENGINEERING

CL141 ENGINEERING MECHANICS

Credits and Hours:

Teaching Scheme	Theory	Tutorial	Practical	Total	Credit
Hours/week	4	-	2	6	5
Marks	100	-	50	150	

A. Objectives of the Course:

This course covers the basic principles of application of forces on rigid body with emphasis on their analysis and application to simple practical engineering problems. The objectives of the course are to:

1. Understand the vector and scalar representation of forces and moments
2. Identify various forces and understand effect of those forces on rigid bodies at the state of rest or motion.
3. Construct free-body diagrams of rigid bodies at static equilibrium
4. Comprehend mechanics associated with friction forces
5. Identify and analyze the internal forces in statically determinate beams.
6. Understand the distributed loads and the centroid of areas/objects.
7. Understand simple dynamic variables involving kinematics, energy and momentum.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	05
2	Fundamental of Statics	22
3	Friction	10
4	Introduction to Beams	05
5	Centroid and Centre of Gravity	10
6	Fundamentals of Kinematics and Kinetics of Particles	08

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1	Introduction	05 Hours	08%
	Introduction of Mechanics, Fundamental concepts and idealization of mechanics, Fundamental principles & Laws of mechanics, Scalar and Vector Quantities, Components , unit vectors and position vector, Composition and resolution of vector, System of Units		
2	Fundamental of Static	22 Hours	38%
2.1	Coplanar Concurrent Force system		
	Introduction of Force , Effect of force and Characteristics of force, Types of force, Type of force systems, Principle of Transmissibility, Resultant of force systems, Resolution of a single force , Composition and Resolution of force system, Resolution method for coplanar concurrent force system		
2.2	Moments and Couples		
	Moment of a force, Principle of moments, Coplanar applications, Parallel force system, Couples, Equivalent couples, Operations with couples, Equivalent system of forces		
2.3	Coplanar Non-Concurrent Force system		
	Introduction, Resultant of coplanar non-concurrent force system, Concentrated and distributed loads		
2.4	Equilibrium of Rigid bodies		
	Equilibrium, Resultant & Equilibrant, Principle of action and reaction, Free body diagram & Lami's theorem, Tensions of strings, condition of equilibrium for Coplanar concurrent forces & Coplanar non-concurrent forces, Equilibrium of Coplanar concurrent forces, Equilibrium of Coplanar non-concurrent forces		
2.5	Forces in Space		
	Introduction, Force in space, resultant of concurrent forces in space, equilibrium of particle in space.		

3	Friction Friction and its applications, Types of friction and Laws of dry friction, Angle of friction, Angle of repose, Coefficient of friction, Block Friction, Ladder friction, Wedge friction	10 Hours	14%
4	Introduction to Beams Types of load, supports and beams, support reaction for Statically determinate beam	5 Hours	10%
5	Centroid and Centre of Gravity Introduction, basic definitions and their understanding, Concept of centre of gravity, Centroids of Linear elements & Planar elements, Determination of centroids by integrations, Centroids of Composite sections (1D, 2D)	10 Hours	16%
6	Fundamentals of Kinematics and Kinetics of Particles Rectilinear motion, Curvilinear motion, Motion of rigid bodies, Velocity and acceleration, Newton's law of motion, Energy and momentum.	8 Hours	14%

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory which carries 5 Marks weightage.
- Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5 Marks as a part of internal theory evaluation.
- Surprise tests/Quizzes/Seminar will be conducted which carries 5 Marks as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the completion of the course one should be able to:

1. Understand laws of mechanics and their application to engineering problems.
2. Use scalar and vector analytical techniques for analyzing forces in statically determinate structures.
3. Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple practical problems.
4. Understand the fundamentals of statics and dynamics and be able to apply them to simple structural problems

F. Recommended Study Material:

Text Books:

1. Junarkar, S.B. & Shah, H.J., Mechanics of Structures Vol-I & II, Charotar Publishing House
2. Junnarkar, S. B. & Shah, H. J., Applied Mechanics, Charotar Publishing House
3. Beer and Johnston, Engineering Mechanics (Statics & Dynamics)

Reference Books:

1. Beer and Johnston, Mechanics of Materials
2. Gere & Timoshenko, Mechanics of Materials, CBS Publishers & Distributors, Delhi
3. Hibbler, R.C., Engineering Mechanics, Pearson Education
4. Popov, E.P., Engineering Mechanics of Solids, Prentice Hall of India, New Delhi
5. Meriam, J. L. & Kraige, L. G., Engineering Mechanics Statics, John Wiley & Son, Singapore
6. A K Tayal, Engineering Mechanics (Statics & Dynamics), Umesh Publications

Web Materials:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Mechanics%20Of%20Solids/index.htm
2. http://nptel.iitm.ac.in/video.php?subjectId=105106116

FACULTY OF TECHNOLOGY & ENGINEERING
CHAMOS MATRUSANSTHA DEPARTMENT OF MECHANICAL ENGINEERING

ME142: WORKSHOP PRACTICES

Credit and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	-	2	-	2	1
Marks	-	50	-	50	

A. Objective of the Course:

The objectives of the this course for the first year engineering students is to impart basic knowledge of various tools and their use in different sections of manufacturing such as fitting, carpentry, welding and machine shop etc. The objective of the course are to:

8. Understand importance of workshop practices along with safety precautions in different shops.
9. Understand the carpentry and fitting work by using various marking, measuring, cutting, striking and inspection tools.
10. Demonstrate simple joining processes and other basic processes like hand forging, sheet metal work, plumbing and plastic production process.

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Introduction to workshop facility.	02
2.	Carpentry shop	06
3.	Fitting shop.	08
4.	Different Metal Joining Processes.	04
5.	Smithy shop.	02
6.	Sheet metal working.	02
7.	Plumbing shop.	02
8.	Introduction to machine tools.	02
9.	Injection molding process.	02

Total hours (Lab): 30

Total hours: 30

C. Detailed Syllabus:

7. Introduction to workshop facility. 02 hours 07%

1.1 Familiarization with work shop facility.

1.2 Introduction to different shops of the workshop.

8. Carpentry Shop. 06 hours 20%

2.1 Introduction to different tools of carpentry shop.

2.2 Making of drawing of the job to be made.

2.3 Making of finished job as per drawing out of the given raw material of wood. Identification on the job for traceability.

9. Fitting Shop. 08 hours 27%

3.1 Introduction to different tools of fitting shop.

3.2 Making of drawing of the job to be made.

3.3 Making of finished job as per drawing out of the given raw material. Identification on the job for traceability.

10. Different Metal Joining Processes. 04 hours 14%

4.1 Introduction to different tools of welding shop.

4.2 Making of drawing of the job to be made.

4.3 Making or demonstration of finished job as per drawing.

4.4 Introduction to Soldering and brazing of metal joining process.

4.5 Joining of two metal sheet or plate by Riveting.

4.6 Making of drawing of the job to be made by riveting.

4.7 Making or demonstration of finished job as per drawing.

11. Smithy Shop. 02 hours 07%

5.1 Introduction to different tools of smithy shop.

5.2 Making of drawing of the job to be made for Cold smithy.

5.3 Making or demonstration of finished job as per drawing.

5.4 Making of drawing of the job to be made for Hot smithy.

5.5 Making or demonstration of finished job as per drawing.

12. Sheet Metal Working. 02 hours 06%

6.1 Introduction to different tools of sheet metal working shop.

6.2 Making of drawing of the job to be made from sheet metal.

6.3 Making or demonstration of finished job as per drawing.

13. Plumbing Shop. 02 hours 06%

7.1 Introduction to all plumbing tools.

7.2 Demonstration of plumbing on the piping model.

14. Introduction to Machine Tools. 02 hours 07%

8.1 Detailed introduction to Lathe machine, Shaping machine, Drilling machine, Grinding machine, Milling machine, Bending machine, Mechanical press.

15. Injection molding process. 02 hours 06%

9.1 Introduction and demonstration to Injection Molding Process for making job out of plastic material.

D. Instructional Method and Pedagogy:

- Attendance is compulsory in laboratory session.
- Journal writing based on above course content and practical work in form of performance practical's by preparing job at the workshop floor.
- In the laboratory discipline and behavior will be observed strictly.
- All the students must follow code of conduct during working at the shop floor.
- Journal should be submitted to the respective course teacher within the given time limit.

E. Student Learning Outcomes:

On the completion of the course one should be able to:

1. Recognize essential tools and process of carpentry.
2. Understand the joining process like welding, soldering and brazing.
3. Recognize essential tools and process of fitting.
4. Recognize various forging and forming processes with the aid of smithy process.
5. Understand different types of sheet metal joints which are useful in working.
6. Recognize different types of fittings and plumbing tools.
7. Identify different machines in workshops along with use.
8. Recognize plastic molding processes.

F. Recommended Study Material:

Text Books:

1. Anderson, James, and Earl E. Tatro. "Shop Theory. 5th ed." (1968).

2. Bawa, H. S. Workshop Technology. India: Tata McGraw-Hill, (1995).

3. Choudhury, Hajra. "Elements of Workshop Technology, Vol. I & II." Media Promotors Pvt Ltd (2009).

4. Raghuwanshi, B. S. Course in Workshop Technology. Dhanpat Rai and Company (P) Limited, (2009).

Reference Books:

1. Chapman, W. A. J. "Workshop Technology Part 1-3." (1998).

2. Tejwani V.K., “Basic Machine Shop Practic e Vol. I, II”, Tata McGraw Hill Pub. Co., New Delhi, (1989).

3. Arora B.D., “Workshop Technology Vol. I, II”, Satya Prakashan, New Delhi, (1981).

Other materials:

Workshop book and manual.

Web sites: http://nptel.ac.in/courses/112107145/

B. Tech. Programme

(Civil/ Mechanical/ Electrical Engineering)

SYLLABI

(Semester – 2)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF MANAGEMENT STUDIES
DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES

HS126.01 A: COMMUNICATION SKILLS – I

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	100	00	100	

A. Objective of the Course:

- To hone basic linguistic and communication skills (of students) required in a business organization, namely: Listening, Speaking, Reading and Writing
- To help learners develop familiarity with varied styles of communication and gain insights into how to deal with people with different communication styles
- To help learners use the language effectively for various functions

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Communicative English • Time and Tenses • Active and Passive Voice • Direct-Indirect Speeches • Prepositions and Conditionals	04
2	Functional English • Introduction to Functional English • Describing Actions and Processes, Offering, Request Routines/Timetable, Making Comparisons, Sharin Interests and Experience	04
3	Conversational Skills • An Introduction to Conversations for various purposes • Importance of acquiring Conversational Skills • Models, Techniques and Types of Conversations	04
4	Introduction to Communication and Key Concepts in Communication • An Introduction to Communication	06

	• Basic Terms, Concepts, and Contexts of Communication • Factors influencing message encoding, the nature of message, and message uses and effects • Importance, Types and Principles of Communication	
5	Effective Listening and Reading Skills • An Introduction to Listening and Reading • Purposes, Types and Techniques of Listening and Reading • Barriers to effective Listening & Reading and overcoming the Barriers • Note-taking and Note-making	06
6	Writing Skills • An Introduction to Writing • Importance of effective Writing • Paragraph Development: Coherence – Topic Sentence, Supporting Sentence & Data etc. • Business Letter Writing	06

Total hours: 30

C. Instructional Method and Pedagogy:

The course is based on pragmatic learning. Classroom Teaching will be facilitated by Reading Material, Classroom Discussions, Task-based learning, projects, assignments and various interpersonal activities like case-studies, critical reading, group-work/pair-work, and presentations.

D. Evaluation:

Students will be evaluated continuously in the form of internal as well as external examinations. Evaluation (Theory) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation in the form of University examination.

Internal Evaluation

Students' performance in the course will be evaluated on a continuous basis through the following components:

Sr. No	Component	Number	Marks per Incidence	Total Marks
1	Assignment/ Project Work	02	25	25
2	Attendance and Class Participation			05
			Total	30

External Evaluation

The University Theory examination will be of 70 marks and will test the reasoning, logic and critical thinking skills of the students by asking them theoretical as well as application based questions. The examination will avoid, as far as possible, grammatical errors and will focus on applications. There will be at least one question on case analysis relevant to the components of the course.

Sr. No.	Component	Number	Marks per Incidence	Total Marks
1	Theory Paper	01	70	70
			Total	70

E. Student Learning Outcomes:

At the end of the course, the students should have polished their grammar and developed the ability to communicate effectively in business situations, they should be able to communicate message accurately, handle situation that require thoughtful communication, to use appropriate words and tones and so on.

F. Recommended Study Material:

- Reference Books:
- Sanjay Kumar and PushpLata (First Edition, 2011), Communication Skills, Oxford University Press, New Delhi
- Krishna Mohan and MeenaBanerji (2010), Developing Communication Skills, Macmillan Publications India Ltd., New Delhi
- M V Rodriques (2013), Effective Business Communication, Concept Publishing Company (P) Ltd., New Delhi
- Mohan and Meenakshi Raman (2006), Effective English Communication Krishna,Mcgraw-Hill Publishing Company Limited, New Delhi
- Geoffrey Leech & Jan Swartvik (1994), A Communicative Grammar of English, Longman Publications, New York
- Jones Leo (1979), Functions of English, Cambridge University Press, UK

Web Materials:

- http://www.communicationskills.co.in/index.html
- http://www.hodu.com/default.htm

- http://www.bbc.co.uk/worldservice/learningenglish
- http://www.englishlearner.com/tests/test.html
- http://www.englishclub.com/vocabulary/idioms-body.htm
- http://dictionary.cambridge.org

FACULTY OF APPLIED SCIENCES
DEPARTMENT OF MATHEMATICAL SCIENCES

MA142: ENGINEERING MATHEMATICS –II

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	4	-	1	5	4
Marks	100	-	-	100	

A. Objective of the Course:

To study the fundamental concepts of Engineering Mathematics, so that students get a sound knowledge and important aspects of the subject.. The objectives of the course are to:

- Understand differential equations, partial differential equations and its solutions
- Understand Multiple Integration and solution techniques.
- Understand different types of Special Functions and its use in Engineering problems

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Ordinary Differential Equations	09
2	Linear Differential Equations	10
3	Partial Differential Equations	11
4	Applications of Ordinary Differential Equations and Partial Differential Equations	10
5	Multiple Integrals	10
6	Special Functions	10

Total hours (Theory): 60

Total hours (Lab): 00

Total hours: 60

C. Detailed Syllabus:

1.	First order and First degree Ordinary Differential Equations	09 Hours	14%
1.1	Modelling of real world problems in terms of first order ODE		
1.2	Initial Value problems		
1.3	Concept of general and particular solutions		
1.4	Existence and Uniqueness solutions by illustrations		
1.5	linear, Bernoulli and Exact differential equations		
1.6	Solutions of First order First degree Differential Equations		
2.	Higher Order Ordinary Linear Differential Equations	11 Hours	18%
2.1	Model of real world problems of higher order LDE		
2.2	General Solution of Higher Order Ordinary Linear Differential Equations with Constant coefficients		
2.3	Methods for finding particular integrals viz. variation of parameters and undetermined coefficients		
2.4	LDE of higher order with variable coefficients viz Cauchy-Euler and Legendre's Equations		
2.5	System of Simultaneous first order linear differential equations		
3	Partial Differential Equations	10 Hours	17%
3.1	Modeling of real world problem in terms of first order PDE		
3.2	Initial and Boundary valued conditions		
3.3	Methods of solutions of first order PDE viz.		
3.4	Langrange's Linear Partial Differential Equations		
3.5	Special types of Nonlinear PDE of the first order		
4	Applications of Differential Equations	10 Hours	17%
4.1	Applications of ODE: Orthogonal Trajectories, Mechanical vibration system, Electrical circuit system, deflection of beams.		
4.2	Application of PDE: Heat, wave, Laplace equations and their solution by method of separation of variables and Fourier series.		
5	Multiple Integrals	10 Hours	17%
5.1	Evaluation of double and triple integrals		
5.2	Change of order of integration		
5.3	Transformation to polar, spherical and cylindrical coordinates		
5.4	applications of double and triple integrals: area, volume and mass		

6. Special Functions 10 Hours 17%

6.1 Improper integrals and their convergence

6.2 Definitions, properties and examples of Beta, Gamma and error functions

6.3 Bessel functions and their Properties

6.4 Legendre’s polynomials and their Properties

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures/laboratory which carries a 5% component of the overall evaluation.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weighting of 5%.
- Two Quizzes (surprise test) will be conducted which carries 5% component of the overall evaluation.

E. Student Learning Outcomes:

- At the end of the course the students will be able to understand the fundamental concepts of Engineering Mathematics. Students will be able to apply these concepts to Mathematics for higher semesters in courses other than Mathematics.

F. Recommended Study Material:

- Text Books:
  1. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Ed., Jhon Wiley & Sons, India, 1999.
- Reference Books:
  1. M.D. Weir, et. al., Thomas’ Calculus, 11th Ed., Pearson Education, 2008
  2. Stewart James, Calculus Early Transcendental, 5th Ed., Thomson India, 2007

3. Wylie & Barrett, Advanced Engineering Mathematics, Mc graw Hill pub.
4. Greenberg, M. D., Advanced Engineering Mathematics, 2nd ed., Pearson

- Web Materials:

1. http://mathworld.wolfram.com/
2. http://en.wikipedia.org/wiki/Math

FACULTY OF TECHNOLOGY & ENGINEERING
MANUBHAI SHIVABHAI PATEL DEPARTMENT OF CIVIL ENGINEERING

CL142: ENVIRONMENTAL SCIENCES

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	2	0	-	2	2
Marks	100	0	-	100	

A. Objective of the Course:

- To impart basic knowledge about environment and thereby developing an attitude of concern towards environment.
- To inculcate alertness towards environment.
- To make awareness on delineating on various environmental pollution and their effects on environment.
- To deliver a comprehensive insight into natural resources, ecosystem and biodiversity.
- To develop the curiosity and visionary of student in relation to environment.

B. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Introduction	05
2	Environmental Pollution	12
3	Ecology & Ecosystems	10
4	Natural Resources	03

Total hours (Theory): 30

Total hours (Lab): 00

Total hours: 30

C. Detailed Syllabus:

1	Introduction	05 Hours	24%
1.1	Basic definitions		
1.2	Objectives and guiding principles of environmental studies		
1.3	Components of environment		
1.4	Structures of atmosphere		
1.5	Man-Environment relationship		
1.6	Impact of technology on the environment		
2	Environmental Pollution	12 Hours	33%
2.1	Environmental degradation		
2.2	Pollution, sources of pollution, types of environmental pollution		
2.3	Air pollution: Definition, sources of air pollution, pollutants, classifications of air pollutants (common like SO_X & NO_X), sources & effects of common air pollutants		
2.4	Water pollution: Definition, sources water pollution, pollutants & classification of water pollutants, effects of water pollution, eutrophication		
2.5	Noise pollution: Sources of noise pollution, effects of noise pollution		
2.6	Ill Effects of Fireworks: Severity of toxicity, environmental effects and health hazards.		
2.7	Current environmental global issues, global warming & green houses, effects, acid rain, depletion of Ozone layer		
3	Ecology & Ecosystems	10 Hours	33%
3.1	Ecology: Objectives and classification		
3.2	Concept of an ecosystem: Structure & function		
3.3	Components of ecosystem: Producers, consumers, decomposers		
3.4	Bio-Geo-Chemical cycles & its environmental significance		
3.5	Energy flow in ecosystem		
3.6	Food Chains: Types & food webs		
3.7	Ecological pyramids		
3.8	Major ecosystems		

4	Natural Resources	03 Hours	10%
4.1	Natural ressources: Renewable resources, non-renewable resources, destruction versus conservation		
4.2	Energy resources: Conventional energy sources & its problems, non-conventional energy sources-advantages & its limitations , problems due to overexploitation of energy resources		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures which carries 10 Marks weightage.
- Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.
- Assignment/Surprise tests/Quizzes/Seminar will be conducted which carries 5 Marks as a part of internal theory evaluation.

E. Student Learning Outcomes:

On the successful completion of the course the students will be able

- To perceive the elementary knowledge about natural environment and its relation with science.
- To identify and analyze human impacts on the environment.
- To understand the facts and concepts of natural and energy resources thereby applying them to lessen the environmental degradation.
- To communicate on recent environmental problems thereby creating awareness among society

F. Recommended Study Material:

- Text Books:
    1. Varandani, N.S., Basics of Environmental Studies
    2. Sharma, J. P., Basics of Environmental Studies

- Reference Books:
  1. Shah Shefali & Goyal Rupali, Basics of Environmental Studies
  2. Agrawal, K.C., Environmental Pollution : Causes, Effects & Control
  3. Dameja, S. K., Environmental Engineering & Management
  4. Rajagopalan, R., Environmental Studies, Oxford University Press
  5. Wright Richard T. & Nebel Bernard J., Environmental Science
  6. Botkin Daniel B. & Edward A. Keller, Environmental Science
  7. Shah, S.G., Shah, S.G. & Shah, G. N., Basics of Environmental Studies, Superior Publications, Vadodara
- Web Materials:
  1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Environmental%20Air%20Pollution/index.htm
  2. http://nptel.iitm.ac.in/video.php?subjectId=105104099
  3. http://apollo.lsc.vsc.edu/classes/met130/notes/chapter1/vert_temp_all.html
  4. http://www.epa.gov
  5. http://www.globalwarming.org.in
  6. http://nopr.niscair.res.in
  7. http://www.indiaenvironmentportal.org.in

FACULTY OF TECHNOLOGY & ENGINEERING
DEPARTMENT OF INFORMATION TECHNOLOGY

IT141: FUNDAMENTALS OF COMPUTER PROGRAMMING

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	3	2	-	5	4
Marks	100	50	-	150	

A. Objective of the course:

The main objectives for offering the course fundamental of computer programming are:

1. To understand basic working of computer and relation of various numerical systems
2. To solve various mathematical problems using algorithms and flowcharts by analyzing and explaining the behavior of simple programs.
3. To study structural programming concepts using various control statements and implement them in C programming language.
4. To study about different concepts, methods of programming and data structures available in C language.
5. To develop programming paradigms through implementing basic mathematical andreal worldproblems.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Computation	03
2	Algorithms for Problem Solving	03
3	Introduction to Programming	02
4	Introduction to ‘C’ language	02
5	Constants, Variables & Data Types in ‘C’	03
6	Operators and Expression in ‘C’	03
7	Managing Input & Output Operations	03
8	Conditional Statements & Branching	04
9	Looping	04
10	Arrays	04

11	Character Arrays	03
12	User-Defined Functions in ‘C’	05
13	Structures and Basics of pointer	06

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed syllabus

Following contents will be delivered to the students during laboratory sessions.

1 Introduction to Computation 03Hours 6%

1.1 Various number systems: Decimal, Binary, Octal, Hexadecimal, conversion from one number system to another

1.2 The basic model of Computation

1.3 What is computer, Algorithms, Flow-charts

2 Algorithms for Problem Solving 03 Hours 6%

2.1 Solve Various types of algorithms like Exchanging values oftwo variables, (using 3 variables & 2 variables), Arrangenumbers in ascending order, Evaluate various series e.g.: sin x, 1^2-2^2+3^2-…, 1+2/2!+3/3!+…,

3 Introduction to Programming 02 Hours 4%

3.1 What is program & programming, programming languages, types of languages, compiler, and interpreter

4 Introduction to ‘C’ language 02 Hours 4%

4.1 History of C, Characteristics of C, Basic structure of a program, Compilingprocess of C a Program

5 Constants, Variables & Data Types in ‘C’ 03 Hours 6%

5.1 Character set, C tokens, Keyword, Constants, and Variables

5.2 Data types – declaration & initialization, User-defined typedeclaration - typedef, enum, Basic input and outputoperations, Symbolic constant (#define)

6 Operators and Expression in ‘C’ 03 Hours 6%

6.1 Classification of operators: arithmetic, relational, logical, assignment, increment / decrement, bitwise, special operators. Unary, binary and ternary operators

6.2 Arithmetic expression, evaluation, type conversion: implicit& explicit, precedence and associativity, use of math.h file

7 Managing Input & Output Operations 03 Hours 6%

7.1 Input a character, introduction to ASCII code, various libraryfunctions from ctype.h

7.2	Formatted input using scanf( ), formatted output of integerand real data using printf ( )		
8	Conditional Statements & Branching	04 Hours	10%
8.1	Decision making using if, if…else statement, nesting of if…else,else…if Ladder		
8.2	switch, use of if…else instead of conditional operator, gotostatement		
9	Looping	04 Hours	10%
9.1	Need of looping, entry-controlled loop: while, for, exit-controlledloop: do…while, difference		
9.2	Nesting of looping statements, use of break and continue, useof if, if…else in loop		
10	Arrays	04 Hours	10%
10.1	Need of array, declaration & initialization 1D array, variousprograms of 1D		
10.2	2D array and their memory allocation, 2D array basicprograms and matrix operations		
11	Character Arrays	03 Hours	6%
11.1	Difference of character array with numeric array andimportance of NULL character		
11.2	Declaration, initialization and various input and outputmethods of string, formatted output of string, arithmeticoperations on characters		
12	User-Defined Functions in 'C'	05 Hours	12%
12.1	Need of modularization, advantages, introduction to user-definedfunction, form of C functions, function prototype, function call, function body		
12.2	Call by value, actual & formal arguments, use of return,nesting of functions,recursion		
12.3	Array as function arguments, storage classes: scope, life of avariable in C		
13	Structures and Basics of pointer	06 Hour	14%
13.1	Need of user-defined data type, structure definition,declaration and initialization of variables, array of structurevariables		
13.2	Background of memory, variable, value, address of variable,introduction to pointer,declaration & initialization, accessvalue using pointer, indirection (*) operator		

D. Instructional method and pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject willbe discussed.Lectures will be conducted with the aid of multi-media projector, black board,OHP etc.
- Two internal exams will be conducted and average of the same will be convertedto equivalent of 15 Marks as a part of internal theory evaluation.
- Assignment/Surprise tests/Quizzes/Seminar will be conducted which carries 5Marks as a part of internal theory evaluation.

- The course includes a laboratory, where students have an opportunity to build anappreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in thelaboratory and tutorial session respectively.

E. Student learning outcome:

Upon completion of this course,

1. A student will be able to study, analyze and understand logical structure of a computer program and different construct to develop a program in ‘C’ language.
2. He will be able to analyze the complexity of problems, modularize the problems into small modules and then convert them into programs.
3. He will be able todevelop efficient programs related to scientific & machine simulationsfor their future projects.
4. He will be able to apply and practice logical ability to solve the real world problems.

F. Recommended study material:

Text books:

1. Programming in ANSI C, E.Balagurusamy, Tata McGraw Hill.

Reference books:

1. C Programming Language (2nd Edition), Brian W. Kernighan, Dennis M. Ritchie, Prentice-Hall (PHI)
2. C: The Complete Reference, Herbert Schildt, McGrawHill
3. Let us C: Yashwant Kanetkar, BPB publications new delhi
4. Computer programming and utilization: M.T.Savaliya, Atul Prakashan
5. Computer concepts and Programming , Vikas Gupta, DreamTech
6. Computer fundamentals and Programming in C, Pradip dey and Manas Ghosh, Oxford.

URL Links:

1. http://www.tutorials4u.com/c/
2. http://www.cprogramming.com/tutorial.html
3. http://www.howstuffworks.com/c.htm
4. http://www.programmingtutorials.com/c.aspx
5. http://www.physics.drexel.edu/courses/Comp_Phys/General/C_basics/

FACULTY OF TECHNOLOGY & ENGINEERING
CHAMOS MATRUSANSTHA DEPARTMENT OF MECHANICAL ENGINEERING

ME143: BASICS OF CIVIL AND MECHANICAL ENGINEERING

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	4	2	-	6	5
Marks	100	50	-	150	

A. Objective of the Course:

This course covers the basics of mechanical and civil engineering. The objectives of the course are to:

1. Introduce the important aspects and applications of mechanical engineering
2. Explain the working of different mechanical systems.
3. Understand the scope and basic elements of civil engineering.
4. Understand the concepts of building planning, surveying and properties of different building materials.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction of Mechanical Engineering	07
2.	Steam and Steam Generator	04
3.	Internal Combustion Engines	06
4.	Pumps and Compressors	03
5.	Refrigeration and Air Conditioning Systems	05
6.	Power and Motion Transmission	05
7.	Scope of Civil Engineering	02
8.	Introduction to Surveying	06
9.	Linear Measurements	07
10.	Elements of building Construction	13
11.	Construction Materials	02

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

PART A:

1. Introduction of Mechanical Engineering — 07 Hours 12%

1.1 Prime movers and its types, Sources of energy

1.2 Basic terminology: Force and mass, Pressure, Work, Power, Energy, Heat, Temperature, Units of heat, Specific heat capacity, Interchange of heat, Change of state, Internal energy, Enthalpy, Entropy, Efficiency

1.3 Zeroth Law and First Law of Thermodynamic, Boyle's law, Charle's law and Combined gas law, Relation between Cp and Cv

1.4 Constant volume process, Constant pressure process, Isothermal process, poly-tropic process, adiabatic process

1.5 Numerical

2. Steam and Steam Generator — 04 Hours 08%

2.1 Introduction to steam formation and its types

2.2 Introduction to steam table

2.3 Calorimeter and its types

2.4 Boiler definition and its classification

2.5 Cochran boiler, Babcock and Wilcox boiler and its mountings and accessories

2.6 Efficiencies of boiler

3. Internal Combustion Engines — 06 Hours 12%

3.1 Introduction

3.2 Basic terminology of I.C. engine

3.3 Types of I. C. engines

3.4 Efficiencies of an engine

3.5 Numerical

4. Pumps and Compressors — 03 Hours 5%

4.1 Introduction

4.2 Classification and application of pumps and compressors,

4.3 Working of Reciprocating and Centrifugal Pump

5.	Refrigeration and Air Conditioning Systems	05 Hours	6%
5.1	Introduction to refrigeration and air conditioning		
5.2	Basic terminology, Principal and application of refrigeration		
5.3	Vapour compression refrigeration system		
5.4	Domestic refrigerator		
5.5	Window and split air conditioning systems		
6.	Power and Motion Transmission	05 Hours	6%
6.1	Introduction		
6.2	Types of couplings, brakes and clutches.		
6.3	Belt drive and its types		
6.4	Gear drives and its types, Gear trains, Chain drives		

PART B:

7.	Scope of Civil Engineering	02 Hours	04%
7.1	Scope of Civil Engineering, Branches of civil engineering, Role of civil engineer		
8.	Introduction to Surveying	06 Hours	10%
8.1	Definition of surveying, Objects of surveying, Uses of surveying,		
8.2	Primary divisions of surveying, Principles of surveying,		
8.3	List of classification of surveying, Definition: Plan and Map, Scales : Plain scale and Diagonal scale, Conventional Symbols		
9.	Linear and Angular Measurements	07 Hours	12%
9.1	Instruments used in chaining, Principle of Chain surveying and terms used in chain surveying, Ranging, Errors in chaining,		
9.2	Examples on errors in chaining		
9.3	Introduction to angular measurements, Concepts of land profiling		
10.	Elements of building Construction	13Hours	20%
10.1	Types of building, Design loads, Building components (super structure and substructure), Principles of Planning, Basics Requirements of a building Planning, Types of Residential Building, Line Diagram, site plan, layout plan and key plan.		
10.2	Basic architectural plan development from line diagram for residential building		

11. Construction Materials 02 Hours 04%

11.1 Types , Uses and Properties of Brick, Cement, Concrete & Timber

D Instructional Methods and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of Multi-Media projector, Black Board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.
- Industrial visits will be organized for students to explore industrial facilities. Students are required to prepare a report on industrial visit and submit as a part of the assignment.

E Student Learning Outcomes:

On the completion of the course one should be able to:

1. Understand fundamental principles, theory and applications of mechanical engineering which plays an important role in industries.
2. Learn the formation of different types of steam and utilize it for the boiler.
3. Understand the basics of internal combustion engine, refrigeration and air conditioning system.
4. Learn different power and motion transmission systems and their applications.
5. Understand importance and application of civil engineering.
6. Understand the fundamentals of surveying and be able to carry out simple survey exercise.
7. Learn about different building components, building planning and design of residential building.
8. Recognize properties of different building materials.

F Recommended Study Material:

Text Books:

1. S.M.Bhatt, H.G.Katariya, J.P.Hadiya, “Elements of Mechanical Engineering”, Books India Publication, Ahmedabad.
2. P.S.Desai, S.B.Soni, “Elements of Mechanical Engineering”, Atul Prakashan, Ahmedabad

Reference Book:

1. Dr. Sadhu Singh, “Elements of Mechanical Engineering”, S.CHAND Publication, New Delhi
2. V.K.Manglik, “Elements of Mechanical Engineering”, PHI Learning, Delhi.
3. Khasia R.B. and Shukla R.N., “Elements of Civil Engineering”, Mahajan Publication.
4. Kandya Anurag, “Elements of Civil Engineering”, Charotar Publishing House Pvt. Ltd.
5. Punamia B.C., “Surveying”, Vol. I & II.

Reading Materials, web materials with full citations:

1. http://nptel.ac.in/downloads/112105125/
2. http://www.slideshare.net/allsaintsscience/7th-grade-ch-2-sec-3-behavior-of-gases?qid=75b08741-fb53-4413-b434-5982afe602bf&v=&b=&from_search=12
3. http://www.slideshare.net/Arjun_Dedaniya/properties-of-steam-62226458?qid=fa8777fd-b543-4128-813c-cf3af3b86579&v=&b=&from_search=2
4. http://www.slideshare.net/shanus1/i-c-engines-a-study?qid=69826356-b9ed-4618-9c77-b2d5a3eac2e3&v=&b=&from_search=8
5. http://nptel.ac.in/syllabus/syllabus.php?subjectId=105104101
6. http://nptel.ac.in/courses/105107122/

FACULTY OF TECHNOLOGY & ENGINEERING
M & V PATEL DEPARTMENT OF ELECTRICAL ENGINEERING

EE141: BASICS OF ELECTRONICS & ELECTRICAL ENGINEERING

Credit Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	4	2	-	6	5
Marks	100	50	-	150	

A. Objectives of the Course:

This course covers the basic principles and laws of electrical and electronics engineering with emphasis on the analysis and application to simple practical engineering problems.

The course objectives (CO) are to:

1. Introduce basic terms and units related to electrical engineering
2. Understand the basic concepts in the field of electrical and electronics engineering
3. Focus on the fundamentals of electrostatic and electromagnetism
4. Analyze the series and parallel AC systems
5. Solve single phase and polyphase circuits
6. Comprehend electronic devices, digital numbers, logic gates and communication systems.

B. Outline of the course:

Sr. No.	Title of Units	Minimum Number of Hours
1.	Basic Electrical Terms and Units	06
2.	Electrical Circuit Analysis	08
3.	Electrostatic	08
4.	Electromagnetism	08
5.	AC and DC Fundamentals	06
6.	Single Phase AC Series and Parallel Circuits	07
7.	Polyphase Circuits	05
8.	Basic of Electronics	12

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1	Basic Electrical Terms and Units	06 Hrs	10%
1.1	Basic terms related to electrical engineering, their definition, units and symbols, equations		
1.2	Ohm's law, resistor and its coding, properties, temperature co-efficient of resistance, resistance variation with temperature, examples		
2	Electrical Circuit Analysis	08 Hrs	13%
2.1	Kirchoff's current and voltage law, mesh and nodal analysis, Examples		
2.2	Series-parallel network, Star-Delta transformations, potential divider		
3	Electrostatic	08 Hrs	13%
3.1	Capacitors, charge and voltage, capacitance, electric fields, electric field strength and electric flux density, relative permittivity, dielectric strength, Examples		
3.2	Capacitors in parallel and series, Calculation of capacitance of parallel plate and multi plate capacitor, examples		
3.3	Energy stored in capacitors, types of capacitor, charging and discharging of capacitors on DC, examples		
4	Electromagnetism	08 Hrs	13%
4.1	Magnetic field, its direction and characteristics, magnetic flux and flux density, magneto motive force and magnetic field strength, examples		
4.2	Faraday's law of electromagnetic induction, Fleming's left hand and right hand rule, Lenz law, force on a current carrying conductor, examples		
4.3	Self and mutual inductance, coefficient of coupling, series and parallel combination of inductances, rise and decay of current in an inductive circuit in DC, examples		
4.4	Comparison between electrical & magnetic circuits		
5	AC and DC Fundamentals	06 Hrs	10%
5.1	Generation of AC and DC voltage, Waveform and definition of its terms, relation between speed, frequency and pole		
5.2	Average and RMS value and its determination for sinusoidal and non-sinusoidal wave shapes, examples		
5.3	Phasor representation of alternating quantities		
6	Single Phase AC Series and Parallel Circuits	07 Hrs	13%
6.1	R –L and R-C series circuit, power in ac circuits, examples		

6.2	R-L-C series circuit, resonance in R-L-C series and parallel circuit, Q – factor and bandwidth, examples		
6.3	Solution of series and parallel circuits, phasor method, admittance method, complex algebra method, examples.		
7	Polyphase Circuits	05 Hrs	08%
7.1	Generation of three phase emf, phase sequence, Definitions		
7.2	Star and delta connection of three phase system, voltage and current relations in star and delta connected system, Examples		
8	Basics of Electronics	12 Hrs	20%
8.1	Electronic Systems: Basic amplifier, voltage, current and power gain, Basic attenuators, CRO		
8.2	Transmission and Signals: Analog and digital signals, bandwidth, modulation and demodulation, Filters		
8.3	Forward and reverse bias of PN junction diode, zener diode, Rectifiers: Half wave, full wave – bridge and centre tap, L and C filters for smoothing		
8.4	Transistor: Bipolar junction transistor, construction and biasing, configuration, transistor as a switch and amplifier		

D. Instructional Method and Pedagogy:

§ At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

§ Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

§ Attendance is compulsory in lectures and laboratory which carries 5 Marks weightage.

§ Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.

§ Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5 Marks as a part of internal theory evaluation.

§ Surprise tests/Quizzes/Seminar will be conducted which carries 5 Marks as a part of internal theory evaluation.

§ The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

§ Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Student Learning Outcomes:

On the completion of the course one should be able to:

- § Identify resistors, capacitors and inductors reating
- § Understand the basic electrical laws and apply these laws to solve electrical network
- § Identify the property of magnetic materials and understand the laws of emf generation
- § Solve the series and parallel AC and DC circuits for single and polyphase networks.
- § Define different terms of alternating quantities
- § Design AC-DC rectification circuits, operate basic electrical and electronics instruments
- § Operate the circuits with logical gates and transistors

F. Recommended Study Material:

Text Books:

1. Elements of Electrical Engineering and Electronics by U.A. Patel and R.P. Ajwalia
2. A Text Book of Electrical Technology by B. L. Thareja, S. Chand
3. Principles of Electrical Engineering and Electronics by V.K. Mehta, S. Chand

Reference Books:

1. Hughes, Electrical Technology, Pearson Education
2. Electrical Engineering by Del Toro

Web Material:

1. Exploring Electrical Engineering
https://www.facstaff.bucknell.edu/mastascu/eLessonsHTML/EEIndex.html
2. Video lectures by Prof. Umanand, IISc Banglore on Basic Electrical Technology
http://nptel.ac.in/courses/108108076/#

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
CHANDUBHAI S. PATEL INSTITUTE OF TECHNOLOGY

TIME TABLE | **SEMESTER-I** | **AY-2018-19**

FY B.TECH DIV 1 | **CLASS: CL-I** | **ROOM NO: 707**

<table>
<tr><th>DAY/TIME</th><th colspan="3">MON</th><th colspan="3">TUE</th><th>WED</th><th colspan="3">THU</th><th>FRI</th><th>SAT</th></tr>
<tr><td>09:10 : 10:10</td><td rowspan="2">CL 141
(B)
PJD
(628-B)</td><td rowspan="2">SC/SS

(C)</td><td rowspan="2">PY 141
(A)
SDK
(724)</td><td rowspan="2">CL 141
(A)
KD
(628-B)</td><td rowspan="2">SC/SS

(B)</td><td rowspan="2">PY 141
(C)
MNS
(724)</td><td rowspan="2">ME 141
(A/B/C)
KKP/ZS/SVD
(726/727)</td><td rowspan="2">CL 141
(C)
PCP
(628-B)</td><td rowspan="2">SC/SS

(A)</td><td rowspan="2">PY 141
(B)
MNS
(724)</td><td>CL 141
BBS
(707)</td><td rowspan="2">SC/SS

(A/B/C)</td></tr>
<tr><td>10:10 : 11:10</td><td>ME 141
NG
(707)</td></tr>
<tr><td>11:10 : 12:10</td><td colspan="12">BREAK</td></tr>
<tr><td>12:10 : 01:10</td><td colspan="3">MA 141(Tutorial)
L4
(707)</td><td colspan="3">MA 141
RVS
(707)</td><td>MA 141
RSU
(707)</td><td colspan="3">CL 141
AJW
(707)</td><td>ME 141
NG
(707)</td><td rowspan="2">SC/SS

(A/B/C)</td></tr>
<tr><td>01:10 : 02:10</td><td colspan="3">CL 141
AJW
(707)</td><td colspan="3">PY 141
USS
(707)</td><td>PY 141
MNS
(707)</td><td colspan="3">MA 141
RSU
(707)</td><td>PY 141
SDK
(707)</td></tr>
<tr><td>02:10 : 2:20</td><td colspan="12">SHORT BREAK</td></tr>
<tr><td>02:20 : 03:20</td><td colspan="3">MA 141
RVS
(707)</td><td colspan="3" rowspan="2">ME 142
(A/B/C)
APP/HB/MO
(126)</td><td rowspan="2">SC/SS

(A/B/C)</td><td colspan="3" rowspan="2">HS 101/(Extra lectures/Tutorial/library)
(A/B/C)</td><td rowspan="2">ME 141
(A/B/C)
NG/ZS/SC
(726/727)</td><td rowspan="2">SC/SS

(A/B/C)</td></tr>
<tr><td>03:20 : 04:20</td><td colspan="3">CL 141
BBS
(707)</td></tr>
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MA141	ENGINEERING MATHEMATICS-I	**RVS**	Mr. RAJESH V SAVALIA	**RSU**	Mr. RAKSHIT S. UPADHYAY		
CL141	ENGINEERING MECHANICS	**AJW**	Mr. ANKIT WANKAWALA	**BBS**	Mr. BHARGAV SHOBHANA	**PCP**	Ms. PINAL PATEL
ME141	ENGINEERING GRAPHICS	**NG**	NIPUN GOSAI	**ZS**	ZANKHAN SONARA	**SC**	SAGAR CHOKSHI
PY141	ENGINEERING PHYSICS	**MNS**	DR. MANAN SHAH	**SDK**	SANNI KAPATEL	**USS**	URVESH SONI
ME142	WORKSHOP PRACTICES	**APP**	ANAND PATEL	**HB**	HARMISH BHATT	**MO**	MADHAV OZA
SC/SS	ASSIGNMENT PRACTICES/STUDUENT COUNSELLING /REMEDIAL CLASSES						
HS101A	A COURSE FROM LIBERAL ARTS						

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
CHANDUBHAI S. PATEL INSTITUTE OF TECHNOLOGY

TIME TABLE **SEMESTER-I** **AY-2018-19**

FY B.TECH DIV 2 **CLASS: CL-II** **ROOM NO: 708**

DAY/TIME	MON	TUE	WED	THU	FRI	SAT
09:10 : 10:10	PY 141 SDK (708)	CL 141 PCP (708)	PY 141 MNS (708)	CL 141 HKS (708)	CL 141 (B) RK (628-B) | SC/SS (C) | PY 141 (A) SDK (724)	SC/SS (A/B/C)
10:10 : 11:10	PY 141 MNS (708)	MA 141 RSU (708)	ME 141 NG (708)	MA 141 RSU (708)		
11:10 : 12:10	**BREAK**					
12:10 : 01:10	ME 141 (A/B/C) NG/VP/ZS (726/727)	ME 141 NG (708)	CL 141 HKS (708)	ME 141 (A/B/C) NG/VP/ZS (726/727)	CL 141 PCP (708)	SC/SS (A/B/C)
01:10 : 02:10		SC/SS (A/B/C)	MA 141 RVS (708)		MA 141 RVS (708)	
02:10 : 2:20	**SHORT BREAK**					
02:20 : 03:20	CL 141 (C) AJW (628-B) | SC/SS (A) | PY 141 (B) MNS (724)	HS 101/(Extra lectures/Tutorial/library) (A/B/C)	CL 141 (A) SCP (628-B) | SC/SS (B) | PY 141 (C) SDK (724)	MA 141(Tutorial) L4 (707)	ME 142 (A/B/C) HB/AV/KKP (126)	SC/SS (A/B/C)
03:20 : 04:20				SC/SS (A/B/C)		

MA141	ENGINEERING MATHEMATICS-I	**RVS**	Mr. RAJESH V SAVALIA	**RSU**	Mr. RAKSHIT S. UPADHYAY	**L3**	
CL141	ENGINEERING MECHANICS	**PCP**	Ms. PINAL PATEL	**HKS**	Dr. HITESHRI SHASTRI	**SCP**	Ms. SARAWATI PATHARIYA
ME141	ENGINEERING GRAPHICS	**NG**	NIPUN GOSAI	**VP**	VIRAL PANARA	**ZS**	ZANKHAN SONARA
PY141	ENGINEERING PHYSICS	**MNS**	DR. MANAN SHAH	**SDK**	SANNI KAPATEL	**USS**	URVESH SONI
ME142	WORKSHOP PRACTICES	**HB**	HARMISH BHATT	**AV**	AKASH VYAS	**KKP**	KHUSHBU PURANI
SC/SS	ASSIGNMENT PRACTICES/STUDUENT COUNSELLING /REMEDIAL CLASSES						
HS101A	A COURSE FROM LIBERAL ARTS						

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
CHANDUBHAI S. PATEL INSTITUTE OF TECHNOLOGY

TIME TABLE | **SEMESTER-I** | **AY-2018-19**

FY B.TECH DIV 3 | **CLASS: ME-I** | **ROOM NO: 709**

<table>
<tr><th>DAY/TIME</th><th>MON</th><th>TUE</th><th colspan="3">WED</th><th colspan="3">THU</th><th>FRI</th><th colspan="3">SAT</th></tr>
<tr><td>09:10 : 10:10</td><td rowspan="2">ME 141
(A/B/C)
SC/MO/VHP
(726/727)</td><td>ME 141
SC
(709)</td><td rowspan="2">CL 141
(B)
KD
(628-B)</td><td rowspan="2">SC/SS
(C)</td><td rowspan="2">PY 141
(A)
SDK
(724)</td><td colspan="3">CL 141
PMS
(709)</td><td>ME 141
SC
(709)</td><td colspan="3" rowspan="2">SC/SS
(A/B/C)</td></tr>
<tr><td>10:10 : 11:10</td><td>MA 141
RVS
(709)</td><td colspan="3">MA 141
RVS
(709)</td><td>PY 141
MNS
(709)</td></tr>
<tr><td>11:10 : 12:10</td><td colspan="12">BREAK</td></tr>
<tr><td>12:10 : 01:10</td><td>CL 141
PMS
(709)</td><td rowspan="2">ME 141
(A/B/C)
SC/KKP/SVD
(726/727)</td><td colspan="3">MA 141 (Tutorial)
L4
(709)</td><td rowspan="2">CL 141
(A)
SCP
(628-B)</td><td rowspan="2">SC/SS
(B)</td><td rowspan="2">PY 141
(C)
MNS
(724)</td><td>MA 141
L4
(709)</td><td rowspan="2">CL 141
(C)
PJD
(628-B)</td><td rowspan="2">SC/SS
(A)</td><td rowspan="2">PY 141
(B)
SDK
(724)</td></tr>
<tr><td>01:10 : 02:10</td><td>MA 141
L4
(709)</td><td colspan="3">SC/SS
(A/B/C)</td><td>CL 141
DGP
(709)</td></tr>
<tr><td>02:10 : 2:20</td><td colspan="12">SHORT BREAK</td></tr>
<tr><td>02:20 : 03:20</td><td>PY 141
USS
(709)</td><td>PY 141
SDK
(709)</td><td colspan="3" rowspan="2">ME 142
(A/B/C)
APP/KKP/AV
(126)</td><td colspan="3" rowspan="2">HS 101A/(Extra lectures/Tutorial/library)
(A/B/C)</td><td rowspan="2">SC/SS
(A/B/C)</td><td rowspan="2">CL 141
(C)
PJD
(627-B)</td><td rowspan="2">SC/SS
(A)</td><td rowspan="2">PY 141
(B)
SDK
(724)</td></tr>
<tr><td>03:20 : 04:20</td><td>SC/SS
(A/B/C)</td><td>CL 141
DGP
(709)</td></tr>
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MA141	ENGINEERING MATHEMATICS-I	**RVS**	Mr. RAJESH V SAVALIA	**L4**			
CL141	ENGINEERING MECHANICS	**DGP**	Mr. DEVANG PATEL	**PMS**	Ms. PINKI SHARMA	**PJD**	Mr. PRAKASH DABHI
ME141	ENGINEERING GRAPHICS	**SC**	SAGAR CHOKSHI	**KKP**	KHUSHBU PURANI	**VHP**	VIKAS PANCHAL
PY141	ENGINEERING PHYSICS	**MNS**	DR. MANAN SHAH	**SDK**	SANNI KAPATEL	**USS**	URVESH SONI
ME142	WORKSHOP PRACTICES	**APP**	ANAND PATEL	**KKP**	KHUSHBU PURANI	**AV**	AKASH VYAS
SC/SS	ASSIGNMENT PRACTICES/STUDUENT COUNSELLING /REMEDIAL CLASSES						
HS101A	A COURSE FROM LIBERAL ARTS						

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
CHANDUBHAI S. PATEL INSTITUTE OF TECHNOLOGY

TIME TABLE | **SEMESTER-I** | **AY-2018-19**

FY B.TECH DIV 4 | **CLASS: ME-II** | **ROOM NO: 710**

<table>
<tr><th>DAY/TIME</th><th>MON</th><th colspan="3">TUE</th><th>WED</th><th colspan="3">THU</th><th>FRI</th><th colspan="3">SAT</th></tr>
<tr><td>09:10 : 10:10</td><td>MA 141
RVS
(710)</td><td colspan="3">ME 141
VHP
(710)</td><td>PY 141
USS
(710)</td><td colspan="3">MA 141(Tutorial)
L3
(707)</td><td rowspan="2">ME 141
(A/B/C)
VP/ZS/VHP
(726/727)</td><td rowspan="2">CL 141
(C)
KD
(627-B)</td><td rowspan="2">SC/SS
(A)</td><td rowspan="2">PY 141
(B)
MNS
(724)</td></tr>
<tr><td>10:10 : 11:10</td><td>CL 141
DGP
(710)</td><td colspan="3">CL 141
PMS
(710)</td><td>CL 141
PMS
(710)</td><td colspan="3">PY 141
MNS
(710)</td></tr>
<tr><td>11:10 : 12:10</td><td colspan="12">BREAK</td></tr>
<tr><td>12:10 : 01:10</td><td rowspan="2">SC/SS
(A/B/C)</td><td colspan="3">PY 141
SDK
(710)</td><td rowspan="2">ME 141
(A/B/C)
VP/SC/NG
(726/727)</td><td colspan="3">CL 141
DGP
(710)</td><td>ME 141
VHP
(710)</td><td colspan="3" rowspan="2">SC/SS
(A/B/C)</td></tr>
<tr><td>01:10 : 02:10</td><td colspan="3">MA 141
RVS
(710)</td><td colspan="3">MA 141
L4
(710)</td><td>MA 141
L4
(710)</td></tr>
<tr><td>02:10 : 2:20</td><td colspan="12">SHORT BREAK</td></tr>
<tr><td>02:20 : 03:20</td><td rowspan="2">ME 142
(A/B/C)
HB/MO/KKP
(126)</td><td rowspan="2">CL 141
(B)
PMS
(628-B)</td><td rowspan="2">SC/SS
(C)</td><td rowspan="2">PY 141
(A)
USS
(724)</td><td rowspan="2">HS 101/(Extra lectures/Tutorial/library)
(A/B/C)</td><td rowspan="2">CL 141
(A)
SCP
(628-B)</td><td rowspan="2">SC/SS
(B)</td><td rowspan="2">PY 141
(C)
MNS
(724)</td><td rowspan="2">SC/SS
(A/B/C)</td><td rowspan="2">CL 141
(C)
KD
(628-B)</td><td rowspan="2">SC/SS
(A)</td><td rowspan="2">PY 141
(B)
MNS
(724)</td></tr>
<tr><td>03:20 : 04:20</td></tr>
</table>

MA141	ENGINEERING MATHEMATICS-I	**L4**		**RVS**	Mr. RAJESH V SAVALIA		
CL141	ENGINEERING MECHANICS	**DGP**	Mr. DEVANG PATEL	**PMS**	Ms. PINKI SHARMA	**KD**	Ms. KANCHAL DAVE
ME141	ENGINEERING GRAPHICS	**VHP**	VIKAS PANCHAL	**SC**	SAGAR CHOKSHI	**ZS**	ZANKHAN SONARA
PY141	ENGINEERING PHYSICS	**MNS**	DR. MANAN SHAH	**SDK**	SANNI KAPATEL	**USS**	URVESH SONI
ME142	WORKSHOP PRACTICES	**HB**	HARMISH BHATT	**KKP**	KHUSHBU PURANI	**MO**	MADHAV OZA
SC/SS	ASSIGNMENT PRACTICES/STUDUENT COUNSELLING /REMEDIAL CLASSES						
HS101A	A COURSE FROM LIBERAL ARTS						

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
CHANDUBHAI S. PATEL INSTITUTE OF TECHNOLOGY

TIME TABLE | **SEMESTER-I** | **AY-2018-19**
FY B.TECH DIV 5 | **CLASS: EE-I** | **ROOM NO: 707/708/709/710**

<table>
<tr><th>DAY/TIM</th><th>MON</th><th colspan="3">TUE</th><th>WED</th><th>THU</th><th colspan="3">FRI</th><th>SAT</th></tr>
<tr><td>09:10 : 10:10</td><td>MA 141
RSU
(707)</td><td colspan="3">MA 141
RSU
(707)</td><td>PY 141
USS
(709)</td><td>SC/SS
(A/B/C)</td><td colspan="3">CL 141
DGP
(708)</td><td rowspan="2">SC/SS
(A/B/C)</td></tr>
<tr><td>10:10 : 11:10</td><td>PY 141
SDK
(707)</td><td colspan="3">PY 141
MNS
(707)</td><td>ME 141
VHP
(709)</td><td>CL 141
BBS
(707)</td><td colspan="3">SC/SS
(A/B/C)</td></tr>
<tr><td>11:10 : 12:10</td><td colspan="10">BREAK</td></tr>
<tr><td>12:10 : 01:10</td><td rowspan="2">ME 142
(A/B/C)
HB/AV/KKP
(126)</td><td rowspan="2">CL 141
(B)
KD
(628-B)</td><td rowspan="2">SC/SS
(C)</td><td rowspan="2">PY 141
(A)
USS
(724)</td><td rowspan="2">HS 101/(Extra lectures/Tutorial/library)
(A/B/C)</td><td>MA 141
RVS
(708)</td><td rowspan="2">CL 141
(A)
SB
(628-B)</td><td rowspan="2">SC/SS
(B)</td><td rowspan="2">PY 141
(C)
USS
(724)</td><td rowspan="2">SC/SS
(A/B/C)</td></tr>
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VHP
(708)</td></tr>
<tr><td>02:10 : 2:20</td><td colspan="10">SHORT BREAK</td></tr>
<tr><td>02:20 : 03:20</td><td>CL 141
DGP
(708)</td><td colspan="3" rowspan="2">ME 141
(A/B/C)
NG/VP/VHP
(726/727)</td><td>MA 141
RVS
(707)</td><td rowspan="2">ME 141
(A/B/C)
NG/VP/VHP
(726/727)</td><td rowspan="2">CL 141
(C)
SCP
(628-B)</td><td rowspan="2">SC/SS
(A)</td><td rowspan="2">PY 141
(B)
USS
(724)</td><td rowspan="2">SC/SS
(A/B/C)</td></tr>
<tr><td>03:20 : 04:20</td><td>MA 141(Tutorial)
B1
(709)</td><td>CL 141
BBS
(707)</td></tr>
</table>

MA141	ENGINEERING MATHEMATICS-I	**RVS**	Mr. RAJESH V SAVALIA	**RSU**	Mr. RAKSHIT UPADHYAY		
CL141	ENGINEERING MECHANICS	**BBS**	Mr. BHARGAV SHOBHANA	**DGP**	Mr. DEVANG PATEL	**KD**	Ms. KANCHAL DAVE
ME141	ENGINEERING GRAPHICS	**VHP**	VIKAS PANCHAL	**VP**	VIRAL PANARA	**NG**	NIPUN GOSAI
PY141	ENGINEERING PHYSICS	**MNS**	DR. MANAN SHAH	**SDK**	SANNI KAPATEL	**USS**	URVESH SONI
ME142	WORKSHOP PRACTICES	**HB**	HARMISH BHAT	**AV**	AKASH VYAS	**KKP**	KHUSHBU PURANI
SC/SS	ASSIGNMENT PRACTICES/STUDUENT COUNSELLING /REMEDIAL CLASSES						
HS101A	A COURSE FROM LIBERAL ARTS						

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
CHANDUBHAI S. PATEL INSTITUTE OF TECHNOLOGY

TIME TABLE | **SEMESTER-I** | **AY-2018-19**

FY B.TECH DIV 6 | **CLASS: EE-II** | **ROOM NO: 707/708/709/710**

<table>
<tr><th>DAY/TIME</th><th colspan="3">MON</th><th>TUE</th><th colspan="3">WED</th><th>THU</th><th>FRI</th><th colspan="3">SAT</th></tr>
<tr><td>09:10 : 10:10</td><td colspan="3">PY 141
USS
(709)</td><td rowspan="2">ME 141
(A/B/C)
ZS/KKP/NG
(726/727)</td><td colspan="3">ME 141
SC
(707)</td><td rowspan="2">ME 141
(A/B/C)
VHP/KKP/SC
(726/727)</td><td>CL 141
PMS
(710)</td><td rowspan="2">CL 141
(A)
AJW
(628-B)</td><td rowspan="2">SC/SS
(B)</td><td rowspan="2">PY 141
(C)
SDK
(724)</td></tr>
<tr><td>10:10 : 11:10</td><td colspan="3">MA 141
RSU
(709)</td><td colspan="3">CL 141
DGP
(707)</td><td>PY 141
MNS
(710)</td></tr>
<tr><td>11:10 : 12:10</td><td colspan="12">BREAK</td></tr>
<tr><td>12:10 : 01:10</td><td rowspan="2">CL 141
(C)
SCP
(628-B)</td><td rowspan="2">SC/SS
(A)</td><td rowspan="2">PY 141
(B)
MNS
(724)</td><td>CL 141
DGP
(709)</td><td rowspan="2">CL 141
(B)
KD
(628-B)</td><td rowspan="2">SC/SS
(C)</td><td rowspan="2">PY 141
(A)
SDK
(724)</td><td>CL 141
PMS
(709)</td><td rowspan="2">SC/SS
(A/B/C)</td><td rowspan="2">CL 141
(A)
AJW
(627-B)</td><td rowspan="2">SC/SS
(B)</td><td rowspan="2">PY 141
(C)
SDK
(724)</td></tr>
<tr><td>01:10 : 02:10</td><td>MA 141
RSU
(709)</td><td>MA 141
RVS
(709)</td></tr>
<tr><td>02:10 : 2:20</td><td colspan="12">SHORT BREAK</td></tr>
<tr><td>02:20 : 03:20</td><td colspan="3" rowspan="2">HS 101A/(Extra lectures/Tutorial/library)
(A/B/C)</td><td>MA 141(Tutorial)
L3
(707)</td><td colspan="3">ME 141
SC
(708)</td><td rowspan="2">ME 142
(A/B/C)
APP/MO/AV
(126)</td><td rowspan="2">SC/SS
(A/B/C)</td><td colspan="3" rowspan="2">SC/SS
(A/B/C)</td></tr>
<tr><td>03:20 : 04:20</td><td>PY 141
SDK
(707)</td><td colspan="3">MA 141
RVS
(708)</td></tr>
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MA141	ENGINEERING MATHEMATICS-I	**RVS**	Mr. RAJESH V SAVALIA	**RSU**	Mr. RAKSHIT UPADHYAY		
CL141	ENGINEERING MECHANICS	**DGP**	Mr. DEVANG PATEL	**PMS**	Ms. PINKI SHARMA	**SCP**	Ms. SARAWATI PATHARIYA
ME141	ENGINEERING GRAPHICS	**SC**	SAGAR CHOKSHI	**KKP**	KHUSHBU PURANI	**NG**	NIPUN GOSAI
PY141	ENGINEERING PHYSICS	**MNS**	DR. MANAN SHAH	**SDK**	SANNI KAPATEL	**USS**	URVESH SONI
ME142	WORKSHOP PRACTICES	**APP**	ANAND PATEL	**MO**	MADHAV OZA	**AV**	AKASH VYAS
SC/SS	ASSIGNMENT PRACTICES/STUDUENT COUNSELLING /REMEDIAL CLASSES						

Division Allocation

Division	Group	Branch	Abbreviation	ID No.
1.	1	Civil Engineering	CL 1	18CL001 to 18CL060
2.			CL 2	18CL061 to 18CL120
3.		Mechanical Engineering	ME 1	18ME001 to 18ME060
4.			ME 2	18ME061 to 18ME120
5.		Electrical Engineering	EE 1	18EE001 to 18EE060
6.			EE 2	18EE061 to 18EE120
7.	2	Computer Engineering	CE 1	18CE001 to 18CE060
8.			CE 2	18CE061 to 18CE120
9.		Information Technology	IT 1	18IT001 to 18IT060
10.			IT 2	18IT061 to 18IT120
11.		Electronics & Communication	EC 1	18EC001 to 18EC060
12.			EC 2	18EC061 to 18EC120

Bach Allocation

Division	Batch	ID NO.	Division	Batch	ID NO.
1	A1	18CL001 to 18CL020	7	A1	18CE001 to 18CE020
	B1	18CL021 to 18CL040		B1	18CE021 to 18CE040
	C1	18CL041 to 18CL060		C1	18CE041 to 18CE060
2	A2	18CL061 to 18CL080	8	A2	18CE061 to 18CE080
	B2	18CL081 to 18CL100		B2	18CE081 to 18CE100
	C2	18CL101 to 18CL120		C2	18CE101 to 18CE120
3	A1	18ME001 to 18ME020	9	A1	18IT001 to 18IT020
	B1	18ME021 to 18ME040		B1	18IT021 to 18IT040
	C1	18ME041 to 18ME060		C1	18IT041 to 18IT060
4	A2	18ME061 to 18ME080	10	A2	18IT061 to 18IT080
	B2	18ME081 to 18ME100		B2	18IT081 to 18IT 100
	C2	18ME101 to 18ME120		C2	18IT101 to 18IT120
5	A1	18EE001 to 18EE020	11	A1	18EC001 to 18EC020
	B1	18EE021 to 18EE040		B1	18EC021 to 18EC040
	C1	18EE041 to 18EE060		C1	18EC041 to 18EC060
6	A2	18EE061 to 18EE080	12	A2	18EC061 to 18EC080
	B2	18EE081 to 18EE100		B2	18EC081 to 18EC100
	C2	18EE101 to 18EE120		C2	18EC101 to 18EC120

Charotar University of Science and Technology
Faculty of Technology and Engineering
Chandubhai S Patel Institute of Technology

List of First Year Student Counselors

Student No.	Faculty Name	Seating Room No.	Intercom Number	Mobile Number
FY B TECH Civil Engineering				
A1 Batch: 18CL001 to 18CL020	Pinal Patel	611	5090	9979975075
B1 Batch: 18CL021 to 18CL040	Gargi Ray	611	5090	8238042155
C1 Batch: 18CL041 to 18CL060	Jay Bhavsar	514	5088	9898583301
A2 Batch: 18CL061 to 18CL080	Devang Patel	503	5085	9624560973
B2 Batch: 18CL081 to 18CL100	Kanchal Dave	615	5236	9978450993
C2 Batch: 18CL101 to 18CL120	Ankit Wankawala	627A	5093	9033108890
FY B TECH Electrical Engineering				
A1 Batch: 18EE001 to 18EE020	Jivanadhar Joshi	116B	5046	9099896476
B1 Batch: 18EE021 to 18EE040	Jigar Sarda	116A	5043	7567702409
C1 Batch: 18EE041 to 18EE060	Rahul Soni	118B	5052	9601716689
A2 Batch: 18EE061 to 18EE080	Pratik Panchal	118B	5052	9429773733
B2 Batch: 18EE081 to 18EE100	Margi Shah	116B	5049	9428070187
C2 Batch: 18EE101 to 18EE120	Mihir Patel	124A	5047	9723315488
FY B TECH Mechanical Engineering				
A1 Batch: 18ME001 to 18ME020	Viral Panara	623	5325	9428575740
B1 Batch: 18ME021 to 18ME040	Sujal Dadhaniya	621	5233	9662255116
C1 Batch: 18ME041 to 18ME060	Satayu Travadi	604	5324	9723833357
A2 Batch: 18ME061 to 18ME080	Rugnesh Patel	621	5233	9825282326
B2 Batch: 18ME081 to 18ME100	Bhavin Mehta	624	5326	9904493399
C2 Batch: 18ME101 to 18ME120	Dr. Gajanan Patange	Workshop: 126	5060	9998716477
FY B TECH Computer Engineering				
A1 Batch: 18CE001 to 18CE020	Trusha Patel	411B	5122	9408737203
B1 Batch: 18CE021 to 18CE040	Dipsi Dave	411B	5122	9409011221
C1 Batch: 18CE041 to 18CE060	Minal Maniar	411B	5122	9408757507
A2 Batch: 18CE061 to 18CE080	Padmavati B	411B	5122	7600969390
B2 Batch: 18CE081 to 18CE100	Nikita Bhatt	411B	5125	9725028431
C2 Batch: 18CE101 to 18CE120	Vaishali Mewada	411B	5122	9624056133
FY B TECH Information Technology				
A1 Batch: 18IT001 to 18IT020	Henish Shah	411B	5122	9427949631
B1 Batch: 18IT021 to 18IT040	Nehal Patel	454	5291	9409483414
C1 Batch: 18IT041 to 18IT060	Amit Parmar	411B	5122	9913040633
A2 Batch: 18IT061 to 18IT080	Harsh Patel	411B	5122	9409272874
B2 Batch: 18IT081 to 18IT 100	Sandip Patel	407	5120	90993 77425
C2 Batch: 18IT101 to 18IT120	Dr. Parth Shah	401	5131	9925020358
FY B TECH Electronics & Communication				
A1 Batch: 18EC001 to 18EC020	Kaushal M. Vala	206	5069	9974407674
B1 Batch: 18EC021 to 18EC040	Upesh P. Patel	206	5069	9913759877
C1 Batch: 18EC041 to 18EC060	Hardik P. Modi	233C	5074	9427083318
A2 Batch: 18EC061 to 18EC080	Dhara P. Patel	207	5070	9825030772
B2 Batch: 18EC081 to 18EC100	Riki H. Patel	205	5068	9662323379
C2 Batch: 18EC101 to 18EC120	Killol V. Pandya	237	5072	7600004093

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY, CHANGA

FACULTY OF TECHNOLOGY AND ENGINEERING

Academic Calender (2018-19) - ODD Semester - B.Tech 1st Sem

Week No	Month	M	T	W	T	F	S	S	Activity
1	July				12	13	14	15	B Tech 1st Sem starts (12/07/2018 to 14/07/2018) (Orientation Program)
2		16	17	18	19	20	21	22	B Tech 1st Sem Academic Session starts (16/07/2018)
		23	24	25	26	27	28	29	
3	August- Sep	30	31	1	2	3	4	5	
4		6	7	8	9	10	11	12	
5		13	14	**DH**	16	17	18	19	
6		20	21	**DH**	23	24	25	26	
7		27	28	29	30	31	1	2	1st Notification of B Tech 1st Sem Attendance Report (01/09/2018)
8	Septmber	**DH**	4	5	6	7	8	9	B Tech 1st Sem 1st Sessional Exam (04/09/2018)
9		10	11	12	13	14	15	16	Result of B Tech 1st Sem 1st Sessional Exam (15/09/2018)
10		17	18	19	20	21	22	23	Workshop: Courses on Liberal Arts (__________ to __________)
11		24	25	26	27	28	29	30	Expert Lecture / Industry Visit /Parents Teacher Meeting
12	October	1	**DH**	3	4	5	6	7	
13		8	9	10	11	12	13	15	
14		15	12	17	**DH**	19	20	21	
15		22	23	24	25	26	27	28	2nd Notification of B Tech 1st Sem Attendance Report (20/10/18)
16	Oct - November	29	30	31	1	2	3	4	B Tech 1st sem 2nd Sessional Exam (22/10/2018)
17		5	6	7	8	9	10	11	**Diwali Break**
18		12	13	14	15	16	17	18	**B Tech 1st/2nd Sem Practical Exam (Tentative) (29/10/2018)**
19		19	20	21	22	23	24	25	**B Tech 1st/2nd Sem (Regular/Backlog) Theory Exam (19/11/2018)**
20	Nov.-Dec.	26	27	28	29	30	1	2	**B Tech 1st/2nd Sem (Regular/Backlog) Theory Exam (cont..)**
21	December	3	4	5	6	7	8	9	**Break only for Students (03/12/2018 to 08/12/2018)**
22		10	11	12	13	14	15	16	**B Tech 2nd sem starts (10/12/2018)**

DH - Declared Holiday

CHANDUBHAI S. PATEL INSTITUTE OF TECHNOLOGY

02/07/2018

Attendance Criteria and Leave Application

This is to inform all the students of First Year B.Tech.

- Students should be regular and punctual to all the classes (Theory, Practical & Tutorials) and secure attendance of not less than 80% in each course. Student should be fully aware that attendance less than 80% in any of the course will make me ineligible to appear for the examination of that course.
- Students should be fully aware that he/she shall not be allowed to enter the class if he/she is late.
- He/she will conduct himself/herself in a highly disciplined and decent manner both inside the classroom and in the campus, failing which suitable action may be taken against the student as per the rules and regulations of the College and University.
- Maximum duration of Leave during the semester is 15 Days only.
- Only Medical leaves in case of Major Surgery/Injury will be granted.
- In case of Major Surgery/Injury, immediate reporting to respective counselor is required.
- Students availing medical leaves need to submit Leave Report along with necessary documents to the Attendance Coordinator of the respective class within a week time. After that no leaves will be sanctioned.
- Students Leave Form is available at PA to Principal Office.
- Further, 100% Attendance is compulsory in Lab Sessions.

Dr A. D. Patel
Principal

Charotar University of Science and Technology
Chandubhai S. Patel Institute of Technology

(Note: In order to make the students aware of the Academic regulations and attend the classes regularly from the first day of starting of classes the following Undertaking Form is introduced which should be signed by both student and parent. The same should be submitted to the concerned HOD through Counselor on the day of starting of semester classes)

Undertaking by Students/Parents for Attendance/Academic Discipline

I, Mr/Ms---bearing ID No.-----------------joining for I / II / IV / VI / VII/ VIII Semester BTech/MTech (CL/ME/CE/IT/EC/EE) for the academic year …………. in Devang Patel Institute of Advance Technology & Research, Changa do hereby undertake and abide by the following terms.

1. I will attend all the classes as per the time table from the re-opening day of the College on ……………….. I also understand that if I do not turn up even after two week of starting of classes, I shall be ineligible to continue for the current academic year.
2. I will be regular and punctual to all the classes (Theory, Practical & Tutorials) and secure attendance of not less than 80% in each subject. I am fully aware that attendance less than 80% in any of the subjects will make me ineligible to appear for the examination of that subject and overall attendance less than 80% will make me ineligible to appear for the whole examinations.
3. I am aware that the mere production of medical certificate will not exempt me from the minimum attendance criteria and all medical leaves are included in the overall 20% relaxation.
4. I am fully aware that I shall not be allowed to enter the class if I am late.
5. I will conduct myself in a highly disciplined and decent manner both inside the classroom and in the campus, failing which suitable action may be taken against me as per the rules and regulations of the College and University
6. I will pay tuition fees, examination fees and any other dues within the stipulated time as required by the University Authorities failing which I will not be permitted to attend the classes and examinations.
7. Violation of any of the undertaking given above will result to my parents meeting the concerned HOD/Principal.

Signature of Student: Date:

ACKNOWLEDGEMENT BY PARENT

I have gone through carefully the terms of the above undertaking given by my ward and understand that following these are for his/her own benefits. I also understand that if he/she fails to comply with these terms, will be liable to suitable action as per College/University rules and law. I undertake that he/she will strictly follow the above terms.

Signature of Parent: Date:

Signature of Counselor Signature of HOD/Principal

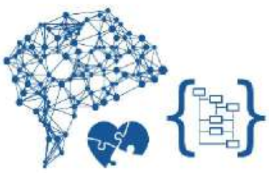
Top 10 skills

in 2020

1. Complex Problem Solving
2. Critical Thinking
3. Creativity
4. People Management
5. Coordinating with Others
6. Emotional Intelligence
7. Judgment and Decision Making
8. Service Orientation
9. Negotiation
10. Cognitive Flexibility

in 2015

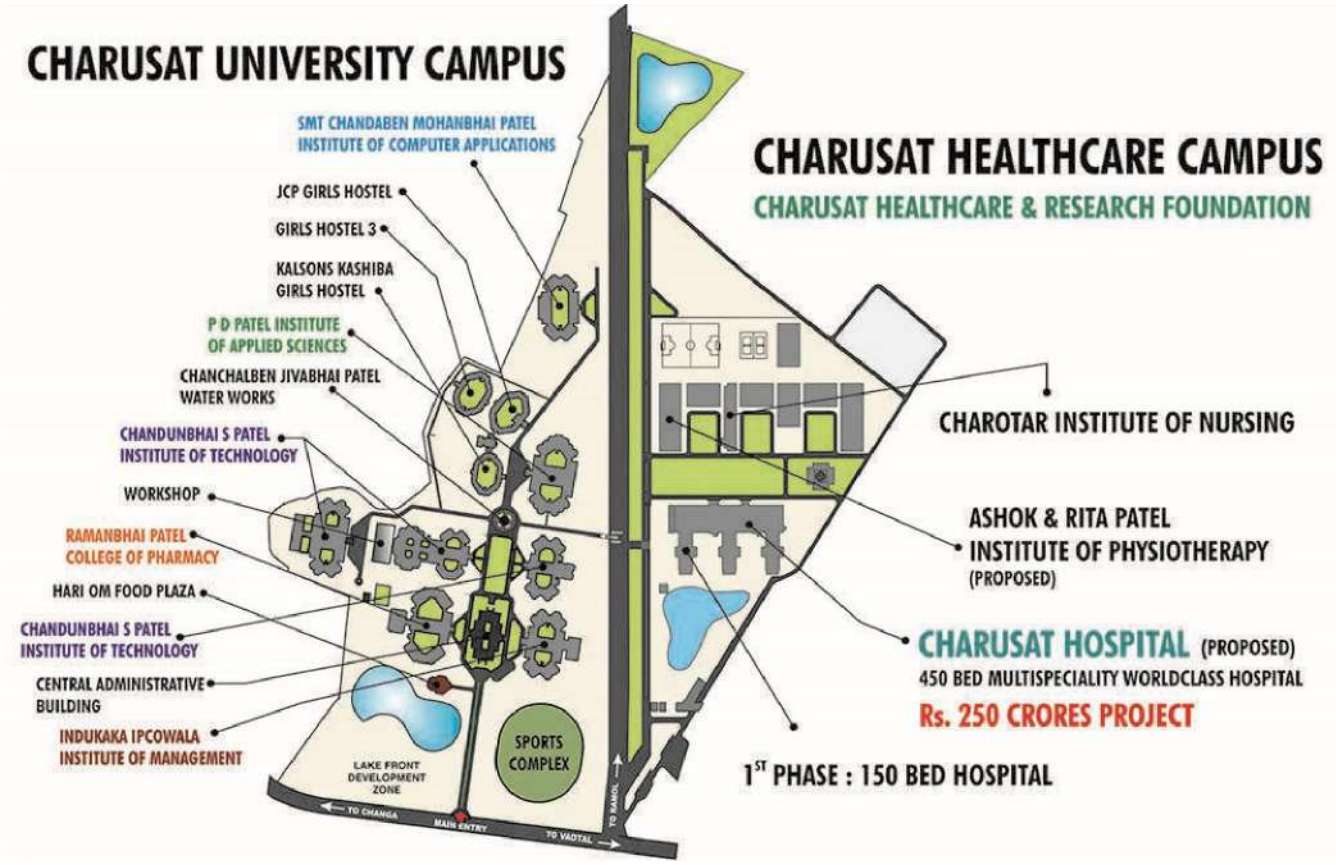
1. Complex Problem Solving
2. Coordinating with Others
3. People Management
4. Critical Thinking
5. Negotiation
6. Quality Control
7. Service Orientation
8. Judgment and Decision Making
9. Active Listening
10. Creativity



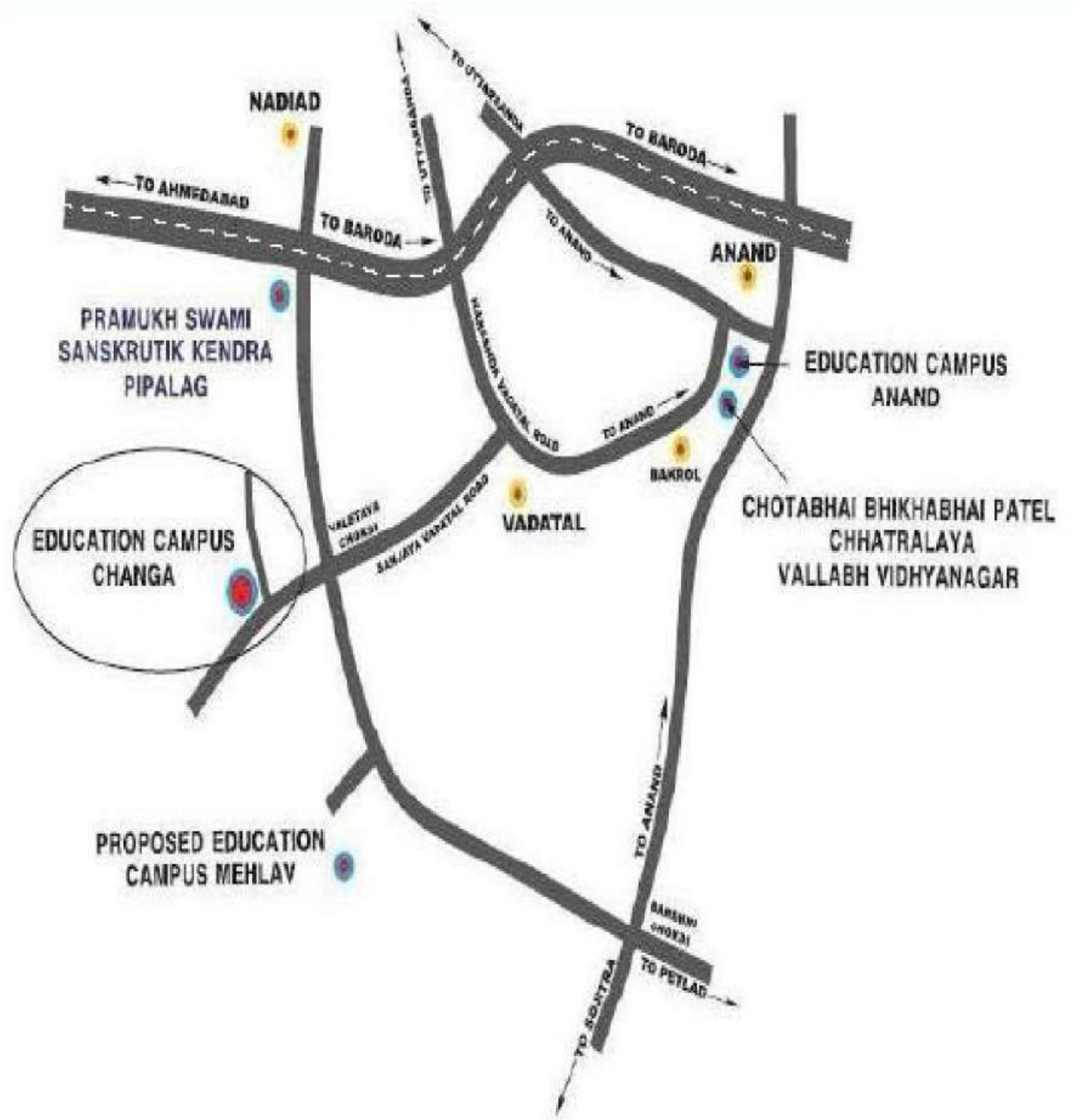
Source: Future of Jobs Report, World Economic Forum

Dean
Faculty of Technology Engineering

CHARUSAT MAP



Reach to CHARUSAT



ACADEMIC REGULATIONS
&
SYLLABUS

(Choice Based Credit System)

Faculty of Technology & Engineering

Bachelor of Technology Programme

(Second Year Mechanical Engineering)

Education Campus – Changa, (ECC), hitherto a conglomerate of institutes of professional education in Engineering, Pharmacy, Computer Applications, Management, Applied Sciences, Physiotherapy and Nursing, is one of the choicest destinations by students. It has been transformed into Charotar University of Science and Technology (CHARUSAT) through an Act by Government of Gujarat. CHARUSAT is permitted to grant degrees under Section-22 of UGC- Govt. of India.

The journey of CHARUSAT started in the year 2000, with only 240 Students, 4 Programmes, one Institute and an investment of about Rs. 3 Crores (INR 30 million). At present there are seven different institutes falling under ambit of six different faculties. The programmes offered by these faculties range from undergraduate (UG) to Ph.D degrees including M.Phil. These faculties, in all offer 23 different programmes. A quick glimpse in as under:

Faculty	Institute	Programmes Offered
Faculty of Technology & Engineering	Chandubhai S. Patel Institute of Technology	B. Tech M. Tech Ph. D
	Devang Patel Institute of Advance Technology and Research	B.Tech CE CSE IT
Faculty of Pharmacy	Ramanbhai Patel College of Pharmacy	B. Pharm M. Pharm Ph. D PGDCT/ PGDPT
Faculty of Management Studies	Indukaka Ipcowala Institute of Management	M.B.A PGDM Ph.D Dual Degree BBA+MBA
Faculty of Applied Sciences	P.D.Patel Institute of Applied Sciences	M.Sc M.Phil Ph.D Dual Degree B.Sc+M.Sc

Faculty	Institute	Programmes Offered
Faculty of Computer Applications	Smt. Chandaben Mohanbhai Patel Institute of Computer Applications	M.C.A/MCA (Lateral) M.Sc IT Ph. D Dual Degree BCA+MCA
Faculty of Medical Sciences	Ashok and Rita Institute of Physiotherapy	B.PT M.PT Ph.D
	Manikaka Topawala Institute of Nursing	B.Sc M.Sc GNM
	Charotar Institute of Paramedical Sciences	Ph.D PGDHA

The development and growth of the institutes have already led to an investment of over Rs.63 Crores (INR 630 Million). The future outlay is planned with an estimate of Rs. 250 Crores (INR 2500 Million).

The University is characterized by state-of-the-art infrastructural facilities, innovative teaching methods and highly learned faculty members. The University Campus sprawls over 100 acres of land and is Wi-Fi enabled. It is also recognized as the Greenest Campus of Gujarat.

CHARUSAT is privileged to have 350 core faculty members, educated and trained in Stanford, IITs, IIMs and leading Indian Universities, and with long exposure to industry. It is also proud of its past students who are employed in prestigious national and multinational corporations.

From one college to the level of a forward-looking University, CHARUSAT has the vision of entering the club of premier Universities initially in the country and then globally. High Moral Values like Honesty, Integrity and Transparency which has been the foundation of ECC continues to anchor the functioning of CHARUSAT. Banking on the world class infrastructure and highly qualified and competent faculty, the University is expected to be catapulted into top 20 Universities in the coming five years. In order to align with the global requirements, the University has collaborated with internationally reputed organizations like Pennsylvania State University – USA, University at Alabama at Birmingham – USA, Northwick Park Institute –UK, ISRO, BARC, etc.

- ☞ Participatory and interactive discussion-based classes.
- ☞ Sessions by visiting faculty members drawn from leading academic institutions and industry.
- ☞ Regular weekly seminars.
- ☞ Distinguished lecture series.
- ☞ Practical, field-based projects and assignments.
- ☞ Summer training in leading organizations under faculty supervision in relevant programmes.
- ☞ Industrial tours and visits.
- ☞ Extensive use of technology for learning.
- ☞ Final Placement through campus interviews.

Exploration in the field of knowledge through research and development and comprehensive industrial linkages will be a hallmark of the University, which will mould the students for global assignments through technology-based knowledge and critical skills.

The evaluation of the student is based on grading system. A student has to pursue his/her programme with diligence for scoring a good Cumulative Grade Point Average (CGPA) and for succeeding in the chosen profession and life.

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

Faculty of Technology and Engineering

ACADEMIC REGULATIONS

Bachelor of Technology (Mechanical Engineering) Programme

(Choice Based Credit System)

Charotar University of Science and Technology (CHARUSAT)
CHARUSAT Campus, At Post: Changa – 388421, Taluka: Petlad, District: Anand
Phone: 02697-247500, Fax: 02697-247100, Email: info@charusat.ac.in
www.charusat.ac.in

Year 2019-20

CHARUSAT

FACULTY OF TECHNOLOGY AND ENGINEERING
ACADEMIC REGULATIONS
Bachelor of Technology Programmes
Choice Based Credit System

To ensure uniform system of education, duration of undergraduate and post graduate programmes, eligibility criteria for and mode of admission, credit load requirement and its distribution between course and system of examination and other related aspects, following academic rules and regulations are recommended.

1. System of Education

Choice based Credit System with Semester pattern of education shall be followed across The Charotar University of Science and Technology (CHARUSAT) both at Undergraduate and Master's levels. Each semester will be at least 90 working day duration. Every enrolled student will be required to take a course works in the chosen subject of specialization and also complete a project/dissertation if any. Apart from the Programme Core courses, provision for choosing University level electives and Programme/Institutional level electives are available under the Choice based credit system.

2. Duration of Programme

(i)	Undergraduate programme	(B.Tech)
	Minimum	8 semesters (4 academic years)
	Maximum	16 semesters (8 academic years)

3. Eligibility for admissions

As enacted by Govt. of Gujarat from time to time.

4. Mode of admissions

As enacted by Govt. of Gujarat from time to time.

5. Programme structure and Credits

As per annexure – 1 attached

6. Attendance

6.1 All activities prescribed under these regulations and listed by the course faculty members in their respective course outlines are compulsory for all students pursuing the courses. No exemption will be given to any student from attendance except on account of serious personal illness or accident or family calamity that may genuinely prevent a student from attending a particular session or a few sessions. However, such unexpected absence from classes and other activities will be required to be condoned by the Dean/Principal.

6.2 Student attendance in a course should be 80%.

7 Course Evaluation

7.1 The performance of every student in each course will be evaluated as follows:

7.1.1 Internal evaluation by the course faculty member(s) based on continuous assessment. The continuous assessment will be conducted by the respective department/ institute.

7.1.2 Final end-semester examination by the University through written paper or practical test or oral test or presentation by the student or combination of these.

7.1.3 The weightages of continuous assessment and end-semester University examination in overall assessment shall depend on individual course as approved by Academic Council through Board of Studies.

7.1.4 The performance of candidate in continuous assessment and end-semester examination together (if applicable) shall be considered for deciding the final grade in a course.

7.1.5 In order to earn the credit in a course a student has to obtain grade other than FF.

7.2 Performance in continuous assessment and end-semester University Examinations

7.2.1 Minimum performance with respect to continuous assessment as well as end-semester university examination will be an important consideration for passing a course. Details of minimum percentage of marks to be obtained in the examinations are as follows:

Minimum percentage marks to be obtained in end-semester University examination (for applicable courses)	Minimum overall percentage marks to be obtained in each course
40%	45%

7.2.2 If a candidate obtains minimum required percentage of marks in end-semester University examination in an applicable course but fails to obtain minimum required overall percentage of marks, he/she has to repeat the examination till the minimum required overall percentage of marks are obtained.

8 Grading

8.1 The total of the internal evaluation marks and final University examination marks in each course will be converted to a letter grade on a ten-point scale as per the following scheme:

Table: Grading Scheme (UG)

Range of Marks (%)	≥80	**≥73 <80**	**≥66 <73**	**≥60 <66**	**≥55 <60**	**≥50 <55**	**≥45 <50**	**<45**
Letter Grade	AA	AB	BB	BC	CC	CD	DD	FF
Grade Point	10	9	8	7	6	5	4	0

8.2 The student's performance in any semester will be assessed by the Semester Grade Point Average (SGPA). Similarly, his performance at the end of two or more consecutive semesters will be denoted by the Cumulative Grade Point Average (CGPA). The SGPA and CGPA are calculated as follows:

(i) SGPA = $\Sigma C_i G_i / \Sigma C_i$ where C_i is the number of credits of course i
G_i is the Grade Point for the course i
and i = 1 to n, n = number of courses in the semester

(ii) CGPA = $\Sigma C_i G_i / \Sigma C_i$ where C_i is the number of credits of course i
G_i is the Grade Point for the course i
and i = 1 to n, n = number of courses of all semesters up to which CGPA is computed.

9. Award of Class

The class awarded to a student in the programme is decided by the final CGPA as per the following scheme:

Award of Class	CGPA Range
First Class with Distinction	CGPA ≥ 7.50
First class	7.50 > CGPA ≥ 6.00
Second Class	6.00 > CGPA ≥ 5.00
Pass Class	5.00 > CGPA ≥ 4.50

Grade sheets of only the final semester shall indicate the class. In case of all the other semesters, it will simply indicate as Pass / Fail.

10. Detention Criteria

- No student will be allowed to move further in next semester if CGPA is less than 3 at the end of an academic year.
- A Student will not be allowed to move to third year if he/she has not cleared all the courses of first year.
- A student will not be allowed to move to fourth year if he/she has not cleared all the courses of first and second year.

11. Transcript

The transcript issued to the student at the time of leaving the University will contain a consolidated record of all the courses taken, credits earned, grades obtained, SGPA,CGPA, class obtained, etc.

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
(CHARUSAT)

FACULTY OF TECHNOLOGY & ENGINEERING (FTE)

CHOICE BASED CREDIT SYSTEM

FOR

BACHELOR OF TECHNOLOGY & ENGINEERING

CHOICE BASED CREDIT SYSTEM

With the aim of incorporating the various guidelines initiated by the University Grants Commission (UGC) to bring equality, efficiency and excellence in the Higher Education System, Choice Based Credit System (CBCS) has been adopted. CBCS offers wide range of choices to students in all semesters to choose the courses based on their aptitude and career objectives. It accelerates the teaching-learning process and provides flexibility to students to opt for the courses of their choice and / or undergo additional courses to strengthen their Knowledge, Skills and Attitude.

1. CBCS – Conceptual Definitions / Key Terms (Terminologies)

Types of Courses: The Programme Structure consist of 4 types of courses: Foundation courses, Core courses, Elective courses and Non-credit (audit) courses.

1.1. Foundation Course

These courses are offered by the institute in order to prepare students for studying courses to be offered at higher levels.

1.2. Core Courses

A Course which shall compulsorily be studied by a candidate to complete the requirements of a degree / diploma in a said programme of study is defined as a core course. Following core courses are incorporated in CBCS structure:

A. University Core courses(UC):

University core courses are compulsory courses which are offered across university and must be completed in order to meet the requirements of programme. Environmental science will be a compulsory University core for all Undergraduate Programmes.

B. Programme Core courses(PC):

Programme core courses are compulsory courses offered by respective programme owners, which must be completed in order to meet the requirements of programme.

1.3. Elective Courses

Generally, a course which can be chosen from a pool of courses and which may be very specific or specialised or advanced or supportive to the discipline of study or which provides an extended scope or which enables an exposure to some other discipline / domain or nurtures the candidates proficiency / skill is called an elective course. Following elective courses are incorporated in CBCS structure:

A. **University Elective Courses(UE)**:

The pool of elective courses offered across all faculties / programmes. As a general guideline, Programme should incorporate 2 University Electives of 2 credits each (total 4 credits).

B. **Institute Elective Course (IE)**

Institute ekective courses are those courses which any students of the University/Institute of a Particular Level (PG/UG) will choose as offered or decided by the University/Institute from time-to-time irrespective of their Programme /Specialisation

C. **Programme Elective Courses(PE)**:

The programme specific pool of elective courses offered by respective programme.

D. **Cluster Elective Course (CE):**

An 'Elective Course' is a course which students can choose from the given set of functional course/ Area or Streams of Specialization options (eg. Common Courses to EC/CE/IT/EE) as offered or decided by the Institute from time-to-time.

1.4. Non Credit Course (NC) - AUDIT Course

A 'Non Credit Course' is a course where students will receive Participation or Course Completion certificate. This will be reflected in Student's Grade Sheet but the grade of the course will not be consider to calculate SGPA and CGPA. Attendance and Course Assessment is compulsory for Non Credit Courses.

1.5. Medium of Instruction

The Medium of Instruction will be English.

Department of Mechanical Engineering – Chandubhai S Patel Institute of Technology

Vision

To provide state of art education in mechanical engineering supported by research and development to cater industrial and social needs.

Mission

To nurture mechanical engineers with strong theoretical foundation, hands-on experience, and high moral and ethical values for the betterment of lives.

To provide an academic environment to demonstrate critical thinking and leadership qualities needed for the development of productive career.

To develop and maintain facilities for continued education, training, research and development in the field of mechanical engineering.

Program Educational Objectives:

1. To develop students with academically rich background with extensive and intensive development of knowledge and skills with an uncompromising attitude towards excellence in the chosen field in the industry and further studies.

2. To develop the technical ability of the students through exposure to Material Sciences, Production Technology, Thermal Engineering, Fluid Mechanics and Computer Aided Design and Manufacturing.

3. To train the students and impart software skills, product design and development, integration of systems to develop cost effective and green technology.

4. To imbibe moral and ethical values with thorough professionalism and motivate the students towards overall personality development and encourage them towards entrepreneurial thinking.

5. To enhance verbal communication, provide a conducive environment for futuristic thinking for a successful professional career.

Program Outcomes: Mechanical Engineering

PO1	Graduates will demonstrate the knowledge of engineering fundamentals, mathematics, science and engineering specialization to solve complex engineering problem.
PO2	Graduates will exhibit the ability to design, identify, analyze and solve problems related to mathematics, science and engineering.
PO3	Graduates will exhibit the ability to design, solve and develop processes or systems which are cost effective, technologically advanced and meets public health, safety and environmental challenges.
PO4	Graduates will demonstrate ability to design and conduct experiments, analyze and interpret data through simulations to arrive at valid conclusions.
PO5	Graduates will demonstrate the skills to use modern methods of engineering, software tools, high-tech equipment's and facilities to solve various problems.
PO6	Graduates will display their abilities in undertaking problems of technological significance with a motive to serve the society.
PO7	Graduates will demonstrate ability to provide professional engineering solution in the contents of societal and environmental sustainability.
PO8	Graduates will exhibit responsibility in ethical and social issues.
PO9	Graduates will demonstrate the ability to work as an individual, and as a member or leader in diverse team and in multi-disciplinary settings.
PO10	Graduates will be effective in formal and informal communication in both verbal and written form and develop managerial skills.
PO11	Graduates will demonstrate the ability to work on multi-disciplinary problems through engineering and management principles.
PO12	Graduates will develop confidence for self-education and ability for life-long learning.

Program Specific Outcomes: Mechanical Engineering

PSO1	The mechanical engineering graduates will be able to analyze, design, and evaluate the performance of mechanical components and systems by using various technological tools.
PSO2	The mechanical engineering graduates will be able to plan and manufacture mechanical components and systems, including selection of material, method and process automation.

TEACHING & EXAMINATION SCHEME
B. TECH. PROGRAMME IN MECHANICAL ENGINEERING

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY (CHARUSAT) *(w.e.f. July 2018)*

TEACHING & EXAMINATION SCHEME FOR SECOND YEAR B. TECH. PROGRAMME IN MECHANICAL ENGINEERING

Sem	Course Code	Course Title	Teaching Scheme				Examination Scheme				
			Contact Hours			Credit	Theory		Practical		Total
			Theory	Practical	Total		Internal	External	Internal	External	
SY Sem–3	MA241	Engineering Mathematics III	4	0	4	4	30	70	00	00	100
	CL243	Mechanics of Solids	4	2	6	5	30	70	25	25	150
	ME242	Engineering Thermodynamics	3	0	3	3	30	70	00	00	100
	ME243	Mechanisms & Machines	4	2	6	5	30	70	25	25	100
	ME244	Manufacturing Processes – I	3	2	5	4	30	70	25	25	150
	XXXXX	University Elective - I	2		2	2	00	00	30	70	100
	HS122A	Values and Ethics	2		2	2	30	70	00	00	100
					28	**25**					**800**
SY Sem–4	ME245	Manufacturing Processes - II	3	2	5	4	30	70	25	25	150
	ME246	Material Engineering & Metallurgy	4	2	6	5	30	70	25	25	150
	ME247	Fluid Mechanics	3	2	5	4	30	70	25	25	150
	ME248	Dynamics of Machines	4	2	6	5	30	70	25	25	150
	MA248	Numerical and Statistical Methods	3	2	5	4	30	70	25	25	150
	HS133A	Creativity, Problem Solving and Innovation	2		2	2	00	00	30	70	100
	XXXXX	University Elective - II	2		2	2	00	00	30	70	100
					31	**26**					**900**

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

List of University Elective Courses under

Choice Based Credit System

Second Year Undergraduate Programme

(Effective from Academic year 2017-18)

Sr. No.	Course Code & Course Name	Department / Faculty offering the Course	Semester in which the course to be offered / Remarks
1	EC281.01: Introduction to MATLAB Programming	EC / FTE	3
2	EC282.01: Prototyping Electronics with Arduino		4
3	CE281.01: Art of Programming	CE / FTE	3
4	CE282.01: Web Designing		4
5	CL281.01: Environmental Sustainability and Climate Change	CL / FTE	3
6	CL282.01: Basics of Environmental Impact Assessment		4
7	EE283: Python For Electrical Engineering	EE/FTE	3
8	EE286: Computer Programming For Electrical Engineering		4
9	IT281.01: ICT Resources and Multimedia	IT/FTE	3
10	IT282.01: Internet Technology and Web Design		4
11	ME281.01: Engineering Drawing	ME/FTE	3
12	ME282.01: Material Science		4
13	PH233.01: Fundamentals of Packaging	RPCP/FPH	3
14	PH238.01: Cosmetics in daily life		4
15	PD260.01: Basic Laboratory Techniques	PDPIAS/FAS	3
16	NR251.01: First Aid & Life Support	NURSING / FMD	3
17	NR261.01: Life Style Diseases & Management		4
18	PT191.01: Health Promotion and Fitness	ARIP / FMD	3
19	PT192.01: Occupational Health & Ergonomics		4
20	CA224: Introduction to Web Designing	CMPICA / FCA	3
21	CA225: Programming the Internet		4
22	BM231: Banking and Insurance	I^2IM / FMS	3
23	BM241: Health Care Management		4
24	PD261: Astrophysics Space and Cosmos-I		3
25	PD262: Astrophysics Space and Cosmos- II		4

B. Tech. (Mechanical Engineering) Programme

SYLLABI

(Semester – 3)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

MA – 241 ENGINEERING MATHEMATICS – III

3rd Semester and 2nd Year

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	0	4	**4**
Marks	100	00	100	

A. Objective of the Course:

- Understand the concepts of Fourier coefficients and Fourier series for the function of different periods.
- Understand the concepts of Laplace transforms to solve differential equations
- Understand the concepts of Matrix algebra
- Understand differentiation, integration of vector fields, determining gradient, curl, directional derivative and their applications.
- Understand role of differential in engineering systems.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Fourier series	10
2.	Laplace Transforms	12
3.	Applications of Differential Equations	10
4.	Matrix Algebra- II	10
5.	Vector Differential Calculus	08
6.	Vector Integral Calculus	10

Total hours (Theory): 60

Total hours (Lab): 00

Total: 60

A. Detailed Syllabus:

1	**Fourier series**	**10 Hours**	**16%**
1.1	Periodic functions, Dirichlet's conditions, Trigonometric series.		
1.2	Euler formulae, Fourier series of periodic function of period.		
1.3	Discontinuous functions, Even and odd functions, Half range series.		
1.4	Fourier series of functions of arbitrary period.		
2	**Laplace Transforms**	**12 Hours**	**22%**
2.1	Laplace transforms as an improper integral and its existence. Laplace transforms of elementary functions.		
2.2	Inverse Laplace transforms, linearity property.		
2.3	First and second shifting theorems, Laplace transforms of derivatives and integrals.		
2.4	Convolution theorem and its application to obtain inverse Laplace transform.		
2.5	Laplace transform of periodic functions, Unit step function, Unit impulse function (Dirac delta function).		
2.6	Solving differential equations using Laplace transforms.		
3	**Applications of differential equations**	**10 Hours**	**16%**
3.1	Applications of ODE: Mechanical vibration system, Electrical circuit system and deflection of beams.		
3.2	Application of PDE: Heat, wave, Laplace equations and their solution by method of separation of variables and Fourier series.		
4	**Matrix Algebra -II**	**10 Hours**	**16%**
4.1	Revision of Determinant and Matrix		
4.2	Eigen values and Eigen vectors of Matrices		
4.3	Eigen values and Eigen vectors of Special Matrices		
4.4	Applications of Cayley - Hamilton Theorem		
5	**Vector Differential Calculus**	**08 Hours**	**14%**
5.1	Revision of concepts of Vector algebra, Scalar and Vector fields.		
5.2	Gradient of a scalar functions, Directional derivatives.		
5.3	Divergence and Curl of a vector field and their properties.		
5.4	Physical interpretations of gradient, divergence and curl. Irrotational, solenoidal and conservative vector fields.		

6 **Vector Integral Calculus** **08 Hours** **14%**

6.1 Line integrals, Surface integrals, Volume integrals

6.2 Statement and examples of Green's theorem, Stokes' and Divergence theorem

6.3 Applications of vector calculus in engineering systems.

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures/laboratory which carries a 5% component of the overall evaluation.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5%.
- Two Quizzes (surprise tests) will be conducted which carries 5% component of the overall evaluation.

E. Student Learning Outcomes:

On successful completion of the course, the student will be able to:

1. Know the various applications of Engineering Mathematics in their respective field e.g. Vector calculus mainly useful for Electromagnetism. Fourier series, Laplace transforms and applications of differential equations widely applicable in Control theory, Structure engineering and Fluid mechanics.
2. Understand Fourier series for the function of different periods
3. Compute Fourier coefficients of the Fourier series for the function of different periods
4. Apply Laplace transform method to solve differential equations
5. Understand matrix and algebra of matrices
6. Apply integration and differentiation methods of vector field
7. Determine gradient, curl, directional derivative.

F. Recommended Study Material:

Text Books:

1. Erwin Kreyszig: Advanced Engineering Mathematics, 8^{th} Ed., Jhon Wiley & Sons, India, 1999.
2. Thomas, G. B., and R. L. Finney. "Calculus with Analytic Geometry (9^{th} Edition), 1996.", Addison Wesley Publishing.

Reference Books:

1. Ahsaan, Zafar. Differential equations and their applications. PHI Learning Pvt. Ltd., 2004.
2. Stewart James: Calculus Early Transcendental, 5th Ed., Thomson India, 2007
3. Wylie & Barrett: Advanced Engineering Mathematics, Mc graw Hill pub.
4. Greenberg M D: Advanced Engineering Mathematics, 2nd ed., Pearson.
5. Anton, Howard. Elementary linear algebra. John Wiley & Sons, 2010.
6. Grewal, B. S. Higher engineering mathematics. Khanna Publisher, New Delhi, 1996.
7. Dass, H. K. Advanced engineering mathematics. S. Chand, 2008.
8. Debnath, Lokenath, and Dambaru Bhatta. Integral transforms and their applications. CRC press, 2014.
9. Stroud, Kenneth Arthur, and Dexter J. Booth. Advanced engineering mathematics. Palgrave Macmillan, 2011.

URL link: Web site: http://mathworld.wolfram.com , http://en.wikipedia.org/wiki/Math

CL243: MECHANICS OF SOLIDS

3rd Semester and 2nd Year

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	2	6	5
Marks	100	50	150	

A. Objective of the Course:

This subject is intended to provide students with a thorough understanding of the theory and application of structural mechanics of deformable bodies. Particular emphasis is on understanding the relationships between loads, member forces and deformations and resulting stresses and strains in a structural member. The objectives of the course are to:

- Learn the fundamental concepts of deformation and the relationship of stress and strain of solids.
- Understand the bending moment, shear force and the corresponding bending and shear stress distribution for different types of statically determinate beam elements with homogeneous and composite structures.
- Understand the concept of moment of inertia of various areas.
- Know the concepts of principal stress and principal planes
- Know the concept of transformation of stresses and strain energy.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1	Introduction	3
2	Simple Stresses and Strains	15
3	Principal Stresses and Strains	10
4	Shear Force and Bending Moment	10
5	Moment of Inertia	6
6	Bending and Shear Stresses in Homogeneous and Composite Beam Sections	10
7	Strain Energy	6

Total hours (Theory):	**60**
Total hours (Lab):	**30**
Total:	**90**

C. Detailed Syllabus:

1	**Introduction**	**03 Hours**	**05%**
1.1	Introduction to mechanics of deformable bodies		
1.2	Principle of superposition		
1.3	Classification of loaded bar		
1.4	Gradual, sudden, impact and shock loading		
1.5	Mechanical properties of materials		
2	**Simple Stresses and Strains**	**15 Hours**	**22%**
2.1	Stress and types of stress, Strain and types of strain		
2.2	Stress strain Characteristics for ductile and brittle materials		
2.3	Shear stresses and strains, Elasticity, Hook's law		
2.4	Axial and shear deformations, Axial force diagram		
2.5	Bars of varying section, Bars of uniformly varying cross section		
2.6	Analysis of stress for statically determinate structures and indeterminate structures		
2.7	Poisson's ratio, Volumetric strain, Biaxial and tri-axial deformations		
2.8	Elastic constant and relation between three elastic constants		
2.9	Stresses due to thermal effect		
3	**Principal Stresses and Strains**	**10 Hours**	**18%**
3.1	Introduction, Sign convention		
3.2	Transformation of stresses for a state of stresses under axial loading		
3.3	Transformation of stresses for plate under biaxial loading		
3.4	Principal plane and principal stresses		
3.5	Maximum shear stress, Element subjected to principal stresses		
3.6	Mohr's circle for stresses on an oblique section of a body subjected to direct stress in one plane and two plane with or without shear stress		
3.7	Pure shear		

4	**Shear Force and Bending Moment**	**10 Hours**	**22%**
4.1	Concept of shear force and bending moment		
4.2	Sign conventions		
4.3	Relation between bending moment, shear force and rate of loading		
4.4	Bending moment and shear force diagrams for statically determinate beams subjected to all different types of loading		
4.5	Important points for shear force and bending moment diagram.		
5	**Moment of Inertia**	**6 Hours**	**12%**
5.1	Introduction, Radius of gyration		
5.2	Parallel axis theorem and perpendicular axis theorem		
5.3	Polar moment of inertia		
5.4	Moment of inertia by integration		
5.5	Moment of inertia of composite areas		
6	**Bending and Shear Stresses in Homogeneous and composite beam sections**	**10 Hours**	**14%**
6.1	Pure bending, Theory of pure bending		
6.2	Assumptions and derivation of theory of simple bending		
6.3	Neutral axis, moment resistance, section modulus		
6.4	Strength of section		
6.5	Bending stress in symmetrical, unsymmetrical and composite sections		
6.6	Shear stresses, Shear flow		
6.7	Shear stress distribution for various cross section		
7	**Strain Energy**	**06 Hours**	**07%**
7.1	Elastic strain energy due to gradual loading, sudden loading, impact loading, shear and bending, Resilience		

D. Instructional Methods and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.

- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Student Learning Outcomes :

On successful completion of the course, the student will be able to:

1. Classify and determine the strength parameters of materials and compute stresses & strains for structural elements due to normal, shear loads and temperature changes.
2. Calculate bending moment and shear force for statically determinate beams and draw the distributions.
3. Calculate the cross sectional moment of inertia using the parallel axis theorem.
4. Use Mohr's circle to determine stresses in a beam under combined loadings.
5. Calculate bending stress, shear stress and their distribution at any desired location along the beam elements.
6. Calculate strain energy due to different loadings.
7. Show expertise in problem identification, formulation and solution for strength of materials problems.
8. Evaluate the different mechanical properties of materials.

F. Recommended Study Material:

Text Books:

1. Junarkar, S.B. & Shah, H.J., Mechanics of Structures Vol-I, Charotar Publishing House
2. Shah, H. J., Mechanics of Solids, Charotar Publishing House
3. Khurmi R. S., Strength of Materials, S. Chand Publications
4. S. S. Bhavikatti, Strength of Materials, Vikas Publishing House Pvt. Ltd
5. Hibbeler, R.C., "Mechanics of Materials", 6th SI edition

Reference Books:

1. Beer and Johnston, Mechanics of Materials
2. Gere & Timoshenko, Mechanics of Materials, CBS Publishers & Distributors, Delhi

3. S. Timoshenko, Strength of Materials (Part -1), D. Van Nostrand Company, Inc.
4. R. Subramanian, Strength of Materials, Oxford University Press
5. S. S. Rattan, Strength of Materials, Tata McGraw Hill Education Pvt. Ltd.
6. R. K. Bansal, Strength of Materials, Lakshmi Publications House Pvt. Ltd.

E Books:

1. Barry Dupen, Applied Strength of Materials for Engineering Technology
2. S. Timoshenko, Strength of Materials (Part -1), D. Van Nostrand Company, Inc

Web Materials:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Mechanics%20Of%20Solids/index.htm
2. http://nptel.ac.in/video.php?subjectId=112107147
3. https://www.youtube.com/watch?v=GkFgysZC4Vc
4. http://nptel.ac.in/syllabus/112106141/
5. http://nptel.ac.in/courses/Webcourse-contents/IIT-Delhi/Mechanics%20Of%20Solids/index.htm

ME – 242 Engineering Thermodynamics

3rd Semester and 2nd Year

Credit Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	0	3	3
Marks	100	00	100	

A. Objective of the Course:

- To provide a mature approach to the basic principles of Thermodynamics.
- To share the knowledge related to energy and its sources with emphasis on energy conversion and transmission to mechanical energy.
- To provide background for higher level subjects of Thermal Sciences.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Fundamental Concepts & Definitions	03
2.	First-Law of Thermodynamics	06
3.	Second Law of Thermodynamics	08
4.	Entropy	10
5.	Availability and Irreversibility	06
6.	General Thermodynamic Relationships	06
7.	Properties of Gases and Mixtures	06

Total hours (Theory): 45

Total hours (Lab): 00

Total: 45

C. Detailed Syllabus:

1 Fundamental Concepts & Definitions 03 hours 07%

1.1 Definition and scope of Thermodynamics, microscopic and macroscopic approaches.

Thermodynamic System and Control Volume, Thermodynamic Properties, path and process, quasi-static process, Thermodynamic equilibrium, Concept of Work and Heat, Zeroth law of thermodynamics.

1.2 Pure Substances: Definition of a pure substance, phase of a substance, triple point and critical points, Vapour- liquid-Solid phase in pure substance with water as example. Representation of pure substance properties on P-T and P-V diagrams, P-V-T surface, Use of mollier diagram.

2	**First Law of Thermodynamics**	**06 hours**	**16%**
2.1	First law of thermodynamics for a closed system undergoing (1) A cycle and (2) Change of state, Internal energy a property of the system, Perpetual motion machine of the first kind		
2.2	Extension of the First law to control volume; Steady flow process, steady state-steady flow energy equation applied to nozzle, throttling process , Turbine & Compressor, Heat Exchanger, adiabatic mixing etc, Transient Flow Processes and its analysis, Filling and emptying process		
3	**Second Law of Thermodynamics**	**08 hours**	**18%**
3.1	Identifications of directions of occurrences of natural processes, Offshoot of II law from the I, Kelvin-Planck and Clasius's statement of Second law of Thermodynamic; Equivalence of the two statements, Carnot cycle analysis.		
3.2	Reversibility and irreversibility- Conditions of reversibility with examples, Carnot Theorem. Thermodynamic temperature scale, Numericals based on above topics.		
4	**Entropy**	**10 hours**	**20%**
4.1	Introduction, Clausius equality and inequality, the property of entropy, Entropy change for open system and reversible processes, Change in entropy of ideal gases, Numericals.		
4.2	Principle of increase of entropy. Third law of thermodynamics, entropy and disorder, Applications of entropy principle and Numericals.		
5	**Availability and Irreversibility**	**06 hours**	**12%**
5.1	Exergy concept, Available energy referred to cycle, nonflow and steady flow process, irreversibility, Second law efficiency, Numericals.		
6	**General Thermodynamic Relationships**	**06 hours**	**13%**
6.1	Introduction, Maxwell's equation, T-ds equations, Difference in heat capacities, Ratio of heat capacities		

6.2 Helm-holtz and Gibbs function, Internal energy relations, Clausius-Claperyon equation, Joule-Thomson Co-efficient

7 Properties of Gases and Mixtures 06 hours 14%

7.1 Introduction to perfect, ideal and real gases, equation of state, Van der Waal's Equation of state, Van der Waal's constants in terms of critical properties

7.2 law of corresponding states, compressibility factor; compressibility chart, and other equations of state

7.3 Gas Vapor Mixtures: Mixture of Ideal Gas, mixture of perfect gases, Dalton's Law of Partial Pressure, Amagat's Law. Concept of Variable Specific heat

D. Instructional Methods and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi–media projector, black board, OHP etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- In the lectures discipline and behavior will be observed strictly.

E. Student Learning Outcomes / objectives:

On successful completion of the course, the student will be able to:

1. Understand the basic concepts of thermodynamics such as continuum, system, control volume, thermodynamic properties, thermodynamic equilibrium, work and heat.
2. Apply first law of thermodynamics to closed system.
3. Analyze boilers, heat engines, compressor, pump, refrigerators and nozzles.
4. Apply Second Law of Thermodynamics and entropy concepts in analyzing the thermal efficiencies of heat engines such as Carnot cycle and the coefficients of performance for refrigerators.
5. Evaluate availability and irreversibility.
6. Derive relationship between measurable and non-measurable thermodynamic properties.
7. Identify the properties of substances on property diagrams and obtain the data from property tables.

F. **Recommended Study Material:**

Text Books:

1. R. Yadav, "Fundamentals of Engineering Thermodynamics", Central Pub House
2. P. K. Nag, "Engineering Thermodynamics", Tata Mcgrraw-Hill Publications

Reference books:

1. Yunus a cengel, "Thermodynamics an engineering approach", Tata Mc GRAW Hill
2. Moren M J, "Fundamentals of Engineering Thermodynamics", John Wiley & Sons
3. Somasundaram S. L., "Engineering Thermodynamics", New Age Pub.
4. Nagaraj P.B., "Basic Thermodynamics", New Age Pub.
5. Arora C P, "Thermodynamics", Tata Mc Graw Hill
6. Rao Y V C, "Theory and Problems of Thermodynamics", Wiley Eastern Ltd

Reading Materials, web materials with full citations:

1. Steam Tables
2. Compressibility Chart
3. http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-BANG/Basic%20Thermodynamics/New_index1.html Web site: http://www.wikipedia.org

Other materials

1. International Journal of Thermal Sciences (Elsevier Publication)
2. Mechanical Engineering (IE)
3. Sadhna (Engineering Sciences) www.ios.ac.in/sadhna

ME – 243 MECHANISMS AND MACHINES

3rd Semester and 2nd Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	02	6	5
Marks	100	50	150	

A. Objective of the Course:

- To learn the relationship between the geometry and the motions of the parts of a machine and the forces that produce this motion.
- To learn how to analyze the motions of mechanisms, design mechanisms to have given motions.
- To provide background for higher level subjects like Dynamics of Machines.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Machines and Mechanism	10
2.	Kinematic Analysis of Mechanism	16
3.	Synthesis of Mechanisms	08
4.	Friction	12
5.	Gears & gear trains	14

Total hours (Theory): 60

Total hours (Lab): 30

Total: 90

C. Detailed Syllabus:

1 Machines and Mechanism **12 Hours 25%**

1.1 Introduction, Machine and Mechanism, Rigid and resistant body, Kinematic pair

1.2 Types of motion, Classification of Kinematic pairs, Degrees of freedom (mobility)

1.3 Kinematic chain, Mechanism, Kinematic analysis of planar mechanisms

1.4 Mobility analysis and range of movement, Grubler's criterion

1.5 Kutzback's criterion, Grashof's law, Inversions of Four–bar chain and slider crank mechanism

1.6 Exact straight line mechanism of peaucelliers, Hart and scott– Russel, Approximate straight line mechanisms of Grasshopper, Watt and Roberts

1.7 Pantograph, steering gear mechanisms, Condition for correct steering, Davis and Ackermann steering gears

1.8 Linkage: Hooke's joint, double Hook's joint, dynamics of Hook's joint

1.9 Oldham's coupling, Intermittent motion mechanism

2 Kinematic Analysis of Mechanism **16 Hours 25%**

2.1 Introduction, Absolute and Relative Motions, Displacement

2.2 Introduction, Absolute and Relative Motions, Displacement by Graphical Method (Relative velocity and acceleration

2.3 Coriolis Acceleration. Acceleration analysis, Klein's Construction, Instantaneous Centre of Velocity

2.4 Kennedy Theorem, Angular velocity ratio theorem, Centrode: Space centrode, Body centrode

2.5 Kinematic analysis by Algebraic methods, Vector Approach, Computer aided Kinematic Analysis of Mechanism like Slider Crank Mechanism, Four–Bar Mechanism

3 Synthesis of Mechanisms **08 Hours 15%**

3.1 Introduction to synthesis of a four bar chain for given instantaneous values of angular velocities and accelerations

3.2 Four bar chain as a function generator, synthesis for two and three position of link, vector methods

3.3 **Synthesis of Mechanisms**

4 Cams **12 Hours 20%**

4.1 Definitions of cam and followers their uses, Types of Cams, Types of Followers and their motion, Cam Terminology

4.2 Displacement Diagrams, Motion of the Followers, Analysis of motion of followers

5 Gears & gear trains **14 Hours 25%**

5.1 Introduction, Classification of Gears, Gear Terminology, Law of Gearing, Velocity of Sliding

5.2 Forms of teeth, Cyclonical Profile Teeth, Involve profile teeth, Path of Contact, Arc of the contact

5.3 Numbers of pairs teeth in contact, Interference in involutes gears, Minimum Number of teeth

5.4 Interference between Rack and Pinion, Under cutting, Efficiency of Helical, Spiral, Worm, Worm Gear and Bevel Gears

5.5 Simple, Compound, Reverted, Epicyclic gear train, Analysis of Epicyclic gear train

D. Instructional Methods and Pedagogy

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- In the lectures the discipline and behavior will be observed strictly.

E. Student Learning Outcomes / objectives:

On successful completion of the course, the student will be able to:

1. Acquire the basic knowledge of the effects of motions on machines and mechanisms
2. Develop the Ability to conduct a complete velocity and acceleration mechanism analysis
3. Understand of basic cam & follower mechanism, classification, CAM motion profiles, and familiarity with introductory cam design considerations
4. Synthesize the planer mechanism like four bar and slider crank using vector and algebraic methods.
5. Understand the gear mechanism, gear classification, gear train analysis, and familiarity with gear standardization and specification in design.

F. Recommended Study Material:

Text Books:

1. Ambekar A. G, "Mechanism and Machine Theory", Jain Brothers
2. Ratan S. S., "Theory of Machines", Tata Mc Graw-Hill publications, New Delhi
3. Ghosh Amitabh, "Theory of Mechanisms and Machines", East West Press

Reference books:

1. Rao J. S. and Dukkipati R. V., "Mechanisms and theory Machines theory", Wiley Eastern Ltd.
2. Shigley J. E. and Uicker J. J., "Theory of Machines and Mechanisms", Oxford University Press.
3. Bevan Thomas, "Theory of Machines" Pearson Education India.
4. Sharma C. S. and Purohit Kamlesh, "Theory of Mechanisms and Machines", PHI.

5. Singh Sadhu, “Theory of Machines”, 2nd Ed. Pearson Education
6. Uicker John J, “Theory of Machines and Mechanism”, Oxford University Press

Reading Materials, web materials with full citations:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Kinematics%20of%20Machine/index.htm
2. http://nptel.iitm.ac.in/video.php?courseId=1018

Programming Languages & Software’s: C, C++, MATLAB , Pro Engineer

Other materials

1. SADHNA (Engineering Science): http://www.ias.ac.in/sadhana/
2. Mechanical Engineering (IE)

ME – 244 MANUFACTURING PROCESSES – I

3rd Semester and 2nd Year

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- To introduce the students about various manufacturing techniques.
- To provide background for higher level subjects in engineering like Production Technology.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Manufacturing Processes	02
2.	Melting Practices	04
3.	Metal Casting Processes	16
4.	Metal Joining Processes	19
5.	Advance Welding Processes	04

Total hours (Theory): 45

Total hours (Lab): 30

Total: 75

C. Detailed Syllabus:

1 Manufacturing Processes **02 Hours** **4%**

1.1 Basic Introduction, Importance of Manufacturing

1.2 Classification and Selection of Manufacturing Processes

2 Melting Practices **04 Hours** **9%**

2.1 Cupola: Charge calculations, construction

2.2 Other Furnaces : working of induction furnace, crucible furnace, and reverberate furnace

3	**Metal Casting Processes**	**16 Hours**	**36%**
3.1	Metal Casting, Sand Casting, Patterns		
3.2	Cores, Gating & Risering Systems, Casting Defects & Inspection		
3.3	Centrifugal Casting, Carbon dioxide molding process		
3.4	Investment casting, Continuous casting		
3.5	Shell molding, Die casting		
3.6	Advanced technologies in casting		
4	**Metal Joining Processes**	**19 Hours**	**42%**
4.1	Classification of Welding, Soldering and Brazing		
4.2	Gas Welding, Fuel Gases, Oxy–Acetylene Welding Equipment and techniques, Gas Cutting Processes		
4.3	Types of Arc Welding, Principle of Arc, Arc Welding Equipment		
4.4	ISI electrode classification, current and voltage selection for electrodes		
4.5	Various arc welding processes		
4.6	General principle of heat generation in resistance welding, Process details and working principle of different resistance welding processes.		
5	**Advanced Welding Processes**	**04 Hours**	**9%**
5.1	Modern welding processes		

D. Instructional Methods and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi–media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Student Learning Outcomes :

On successful completion of the course, the student will be able to:

1. Acquire basic knowledge of manufacturing processes.
2. Develop ability to forecast the composition of metal/alloy obtain from furnaces.
3. Acquire basic knowledge of different furnaces.
4. Acquire basic knowledge of various casting processes and to analyze casting defects.
5. Understand the basics of welding processes.
6. Understand the different types of welding processes in depth and analyze the defects by penetration test.
7. Impart the knowledge of advanced welding processes.

F. Recommended Study Material:

Text Books:

1. Rao P. N., "Manufacturing Technology – Foundry, Forming & Welding", Vol. 2, 4th Edition, Mc Graw Hill Education (India)
2. Ghosh A. and Mallik A. K., "Manufacturing Science", 2nd edition, East West Press-2010
3. Kalpakjian S. and Schmid S.R., "Manufacturing Engineering and Technology", 7th Edition, Pearson-2013
4. Sharma P.C., "A Textbook of Production Technology (Manufacturing Processes)", 8th Edition, S. Chand Publishing

Reference books:

1. Kumar Rajeev, "Manufacturing Processes"- Prentice Hall India Learning Private Limited -2014
2. Groover M. P., "Fundamentals of Modern Manufacturing", 5th edition, Wiley-2012
3. Lindberg Roy A, "Processes and materials of manufacture", Fourth edition PHI, 1990
4. Schey J., "Introduction to Manufacturing Processes", Tata McGraw Hill-1999
5. Parmar R.S., "Welding Processes and Technology ", Khanna Publishers
6. Jain P.L., "Principles of Foundry Technology", 5th Edition, Mc Graw Hill Education (India)
7. Ravi B., "Metal Casting: Computer Aided Design and Analysis", PHI Publication

Reading Materials, web materials with full citations:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-ROORKEE/MANUFACTURING-PROCESSES/index.htm
2. Foundry Informatics Centre, New Delhi, http://www.foundry info-india.org

Other materials

1. Journal of Material Processing Technology (Elsevier Publication)
2. Production Engineering (IE) http://www.ipcourseline.org
3. Sadhna-Indian Academy of Sciences, http://www.ias.ac.in/sadhana
4. E-Foundry, http://efoundry.iitb.ac.in

HS – 122A VALUES AND ETHICS

3rd Semester and 2nd Year

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	100		100	

A. Objective of the Course:

To facilitate learners to:

- develop a familiarity with the mechanics of values and ethics
- understand basic concepts of values and ethics
- explore and understand values, ethics in context of professional, social and personal spectrum
- explore and understand values, ethics in context of globalization and global issues
- explore an application of values and ethics in personal, social, academic, global and profession life.
- facilitate the learners to understand harmony at all the levels of human living, and live accordingly.

B. Outline of the Course:

Module No.	Title/Topic	Classroom Contact Hours
1	**Introduction to Values and Ethics** • *Need, Relevance and Significance of Values and Ethics : General* • *Concept and Meaning of Values and Ethics*	06
2	**Elements and Principles of Values** • *Universal & Personal Values* • *Social, Civic & Democratic Values* • *Adaptation Models & Methods of Values*	08
3	**Applied Ethics** • *Universal Code of Ethics* • *Professional Ethics* • *Organizational Ethics* • *Ethical Leadership* • *Domain Specific Ethics*	08

4	**Value, Ethics & Global Issues** • *Cross-Cultural Issues* • *Role of Ethics & Values in Sustainability* • *Case Studies*	08
	Total	30

C. Instruction Methods and Pedagogy

The course is based on practical learning. Teaching will be facilitated by reading material, discussion, task-based learning, projects, assignments and various interpersonal activities like case studies, critical reading, group work, independent and collaborative research, presentations etc.

D. Evaluation

The students will be evaluated continuously in the form of internal as well as external examinations. The evaluation (Theory) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation in the form of University examination.

Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
3	Assignment / Project Work	2	25	25
4	Attendance and Class Participation			05
			Total	30

External Evaluation

The University Theory examination will be of 70 marks and will test the reasoning, logic and critical thinking skills of the students by asking them theoretical as well as application based questions. The examination will avoid, as far as possible, grammatical errors and will focus on applications. There will be at least one question on case analysis relevant to the components of the course.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Theory Paper	01	70	70
			Total	70

E. Learning Outcomes

On successful completion of the course, the student will be able to:

1. Understand the concepts and mechanics of values and ethics.
2. Understand the significance of value and ethical inputs in and get motivated to apply them in their life and profession.
3. Understand the significance of value and ethical inputs in and get motivated to apply them in social, global and civic issues.

F. Reference Books / Reading

- Human Values and Ethics in Workplace, United Nations Settlement Program, 2006. (http://www.unwac.org/new_unwac/pdf/HVWSHE/Human%20Values%20&%20Ethics%20-%20Individual%20Guide.pdf).
- Ethics for Everyone, Arthur Dorbin, 2009. http://arthurdobrin.files.wordpress.com/2008/08/ethics-for-everyone.pdf).
- Values and Ethics for 21st Century, BBVA. (https://www.bbvaopenmind.com/wp-content/uploads/2013/10/Values-and-Ethics-for-the-21st-Century_BBVA.pdf)
- www.ethics.org

B. Tech. (Mechanical Engineering) Programme

SYLLABI

(Semester – 4)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

ME – 245 MANUFACTURING PROCESSES –II

4th Semester and 2nd Year

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/Week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- To introduce students, various machine tools with their arrangement, tooling and machining processes performed thereon.
- To make aware the students about various metal cutting, metal forming and metal working practices.

B. Outline of the Course:

Sr. No	Title of Unit	Minimum number of Hours
1.	Metal Cutting Lathes	08
2.	Drilling and Boring Machines	03
3.	Milling Machines	04
4.	Planers, Shapers and Slotters	03
5.	Sawing and Broaching Machines	02
6.	Grinding Machines and Abrasives	03
7.	Fundamentals of Metal Forming	07
8.	Rolling	03
9.	Forging	04
10.	Extrusion	03
11.	Drawing Operations	02
12.	Press Working and Dies	03

Total hours (Theory): 45

Total hours (Lab): 30

Total: 75

C. Detailed Syllabus:

1	**Metal Cutting Lathes**	**08 Hours**	**18%**
1.1	Engine Lathes, Construction, Arrangement and Principle, Units of engine lathes, Type and size range of engine lathes.		
1.2	Operations carried on engine lathe, Attachment extending the processing capacities of engine lathes.		
1.3	Description of other types of lathes, Plain turning lathes, Facing lathes, Multiple tool lathes.		
1.4	Simple purpose lathes, Turret lathes, Horizontal and Vertical lathes.		
2	**Drilling and Boring Machines**	**03 Hours**	**07%**
2.1	Purpose and field of application of drilling and boring machines.		
2.2	Upright drill processes, radial drills, Horizontal and Precision Boring Machines.		
3	**Milling Machines**	**04 Hours**	**08%**
3.1	Purpose and types of milling machines, general purpose milling machines.		
3.2	Different types of milling operations.		
3.3	Milling cutters, attachments extending the processing capabilities of general purpose milling machines.		
4	**Planers, Shapers and Slotters**	**03 Hours**	**07%**
4.1	Classification, Attachments extending the processing capacities of each.		
5	**Sawing and Broaching Machines**	**02 Hours**	**04%**
5.1	Metal sawing – classification; Reciprocating sawing machines, Circular sawing machines, Band sawing machines.		
5.2	Types of broaching machines, Advantages and Limitations of Broaching.		
6	**Grinding Machines and Abrasives**	**03 Hours**	**07%**
6.1	Classifications of grinding machines, Cylindrical grinders, Internal grinders, Surface grinders, Tool and Cutter grinders.		

6.2 Surface finishing, Abrasives, Manufacture of grinding wheels.

7	**Fundamentals of Metal Forming Processes**	**07 Hours**	**16%**
7.1	Introduction, Classification of Forming Processes, Mechanics of Metal Working.		
7.2	Various Temperatures in Metal Working, Cold and Hot Working. Formability, Strain Rate Effects on metal forming, Effects of Metallurgical Structure on Metal Forming, Hydro Static Pressure, Residual Stresses.		
8	**Rolling**	**03 Hours**	**07%**
8.1	Introduction and classification of Rolling processes, Principles of Metal Rolling, Simplified Analysis of Rolling Load, Various Rolling Parameters.		
8.2	Defects in rolled products and remedies of it.		
9	**Forging**	**04 Hours**	**08%**
9.1	Introduction and classification of Forging Processes, Various Forging Operations, Forging Die Materials and Lubrication, Forge ability, Forging Defects and remedies.		
10	**Extrusion**	**03 Hours**	**07%**
10.1	Introduction and classification of Extrusion Processes, Various Extrusion Operations, Metal Deformation and Forces in Extrusion.		
10.2	Materials and Lubrication considerations in Extrusion Process, Extrusion Defects, Extrusion of Tubing, Production of Seamless Pipe and Tubing.		
11	**Drawing Operations**	**02 Hours**	**04%**
11.1	Drawing of Rods, Wires and Tubes, Sizing.		
12	**Press Working and Dies**	**03 Hours**	**07%**
12.1	Types of presses drive and feed mechanisms, press tools.		
12.2	Various press working operations and its parameters, Elements of press, Various Metal Forming Operations.		
12.3	Stock strip layout, study of sheet metal nesting software.		

D. Methods and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Student Learning Outcomes:

On successful completion of the course, the student will be able to:

1. Understand working of lathe, shaper and planer, drilling, milling and grinding machines.
2. Comprehend speed and feed mechanisms of machine tools.
3. Study and practice on machine tools and their operations
4. Estimate machining times for machining operations on machine tools.
5. Gain knowledge of classification of metal forming processes, plastic deformation, flow stress, formability, strain, effect of temperature, strain rate and metallurgical structure on metal working, friction and lubrication, deformation zone geometry, workability, and residual stresses.
6. Understand metal forming processes like forging, drawing, rolling, extrusion, and deep drawing.

F. Recommended Study Material:

Text Books:

1. Rao P. N., “Manufacturing Technology Vol. 2 – Metal Cutting and Machine Tools”, Tata McGraw Hill, 3rd Edition , 2013.
2. Rao P. N., “Manufacturing Technology – Foundry, Forming and Welding”, Tata McGraw Hill, 4th Edition, 2013.
3. Jain.R.K, “Production Technology: Manufacturing Processes, Technology and Automation”, Khanna Publishers, 17th Edition, 2011.

Reference Books:

1. Hajara Choudhury S. K., “Elements of Work-Shop Technology Vol. – I”, Media Promoters , 2008.

2. Hajara Choudhury S. K., “Elements of Work–Shop Technology Vol. –II”, Media Promoters, 2010.
3. Kalpakajian S., “Manufacturing, Engineering and Technology”, Pearson Education Canada, 7th Edition, 2013.
4. Chapman W. A., “Workshop Technology Vol. I and II and III”, CBS publishers & distributors pvt. ltd.

Web Material:

http://nptel.iitm.ac.in/courses.php?branch=Mechanical

Other Material:

http://www.sciencedirect.com/science/journal/09240136

http://www.ieindia.org/publish/pr/pr.htm

http://www.ieindia.info/public.asp/me/me.htm

http://www.ias.ac.in/sadhana/

ME - 246 Material Engineering & Metallurgy

4^{th} Semester and 2^{nd} Year

Credit Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	2	6	5
Marks	100	50	150	

A. **Objectives of the Course:**

- To introduce the student about the properties of various engineering materials, so that they can earn knowledge to select and use proper material engineering application.
- To share the knowledge related to materials properties, characteristics, testing, selection and application.
- To know about how to explore new material with unique properties i.e. design of new material as per requirements of application.

B. **Outline of the Course:**

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction to material Engineering and metallurgy	03
2.	Crystal Structure and Imperfection	04
3.	Phase Diagrams and Iron Carbon System	04
4.	Cast Iron and wrought iron	04
5.	Alloy Steel	04
6.	Heat Treatment of Steels	12
7.	Non-ferrous alloys	04
8.	Powder Metallurgy	06
9.	Corrosion and degradation of metals	05
10.	Materials testing and inspection	08
11.	Composite Materials	06

Total hours (Theory): 60

Total hours (Lab): 30

Total: 90

C. Detailed Syllabus:

A	**Machine Design**		
1	**Introduction to Material Engineering and Metallurgy**	**03 Hours**	**5%**
1.1	Classification of Engineering Materials.		
1.2	Engineering requirements of materials.		
1.3	Properties of engineering materials.		
1.4	Criteria for selection of materials for engineering applications.		
1.5	Concept of Plastics Materials, Classification, Properties and Application of plastics.		
1.6	Concept of Electronic Materials, Classification, Properties and Application of Electronics Materials.		
1.7	Types of Metallurgical Processes.		
2	**Crystal Geometry and Imperfections**	04 Hours	7%
2.1	Crystal systems, crystallographic points, directions and planes.		
2.2	X ray diffraction and Bragg's law.		
2.3	Imperfection in solids – point, line, and surface defects, Dislocation moments.		
3	**Phase Diagrams and Iron Carbon System**	04 Hours	7%
3.1	Gibbs phase rule and phase diagrams Type I, II, III.		
3.2	Iron carbon diagram.		
3.3	Structure Properties Relationship.		
4	**Cast Iron and wrought iron**	04 Hours	7%
4.1	Grades of C.I.		
4.2	Alloyed Cast Iron, Malleable Iron and S. G. Iron.		
4.3	Wrought Iron Properties and uses.		
5	**Alloy Steel**	**04 Hours**	**7%**
5.1	Classification of Steels.		
5.2	Properties and uses.		
5.3	Effects of different alloying metals.		

6	**Heat Treatment of Steels**	**12 Hours**	**18%**
6.1	Study of Heat-Treatment processes and TTT diagram.		
6.2	Normalizing, Annealing, Spheroidizing.		
6.3	Hardening, tempering, austempering.		
6.4	Martempering, case-hardening, nitriding, cyaniding.		
6.5	Induction hardening, flame-hardening, ageing.		
6.6	Application of above processes in mechanical components such as gears, bearing, turbine blades, crankshafts, pistons, cutting tool materials.		
7	**Non-ferrous alloys**	**04 Hours**	**6%**
7.1	Extraction of copper, aluminum and nickel.		
7.2	Alloys of copper, aluminum, Magnesium, lead, tin, zinc, nickel, titanium, bearing alloys.		
8	**Powder Metallurgy**	**06 Hours**	**10%**
8.1	Application, advantages and limitation of Powder metallurgy.		
8.2	Production of powder.		
8.3	Compacting, Sintering.		
8.4	Equipment and process capability.		
9	**Corrosion and degradation of metals**	**05 Hours**	**7%**
9.1	Meaning, causes and nature of corrosion		
9.2	Intergranular corrosion (IGC),Hydrogen embrittlement		
9.3	Measures of counteracting corrosion		
9.4	Metal coatings, Organic coatings, Lining and cladding, Use of Corrosion inhibitors, cathodic protection against corrosion.		
10	**Materials testing and Inspection**	**08 Hours**	**18%**
10.1	Introduction to Non-destructive testing.		
10.2	Radiography Testing.		
10.3	Dye Penetration Testing, Magnetic Particle Testing.		
10.4	Ultrasonic Testing.		
10.5	Jominy end quench test.		
10.6	Macro-examination, Spark Test, Macro-etching, Fracture.		
10.7	Microscopic examinations.		
10.8	Electron Microscopy, Magnetic Testing.		
10.9	Chemical analysis of steel and Iron.		

11 **Composite Materials** **06 Hours** **08%**

11.1 Types and application of composites.

11.2 Particle reinforce composites, Influence of fiber orientation and concentration.

11.3 Fiber phase and the matrix phase, Polymer matrix composite.

11.4 Metal matrix composite, ceramic matrix composite and carbon-carbon composites.

D. Instructional Methods and Pedagogy

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi–media projector, black board, OHP etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- In the lectures the discipline and behavior will be observed strictly.

E. Student Learning Outcomes:

On successful completion of the course, the student will be able to:

1. Understand the crystal structure and classification of materials.
2. Interpret the phase diagrams of materials.
3. Classify cast irons, wrought iron and study their applications.
4. Select suitable heat treatment process to achieve desire properties of metals and alloys.
5. Understand the concept of materials testing and Inspection.
6. Develop concept of corrosion and its prevention.
7. Explore various extraction processes to get the different form of materials.

F. Recommended Study Material:

Text Books:

1. Callister W. D. Jr, “Materials science and engineering : An Introduction”, Edition:-2006, Wiley India, New Delhi, India
2. Narang G. B. S. and Manchanedy K., “Materials and Metallurgy”, Khanna Pub New Delhi, India
3. Swaroop D. and Saxena M. N., “Elements of Metallurgy”, Rastogi Pub, Mearut, India
4. Dharmendra K umar and Jain S. K., “Material science and manufacturing process”, Vikas Pub House, New Delhi, India
5. Reed R. E., “Physical Metallurgy Principles”, Cengage Learning, 2009

Reference books:

1. Raghvan V., "Metallurgy for engineers", Prentice Hall of India
2. Avner Sidney H., "Physical Metallurgy", Tata Mcgraw Hill Education
3. Khanna O. P., "Material Science - A Text Book of Material Science & Metallurgy", Dhanpat Rai Publisher

Reading Materials, web materials with full citations:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIScBANG/Material%20Science/New_index1.html
2. http://ocw.mit.edu/OcwWeb/web/courses/courses/index.htm#MaterialsScienceandEngineering

Other materials

1. Metallurgical & Materials Engineering (IE)
2. Sadhna (Engineering Sciences) www.ios.ac.in/sadhna
3. NDT & E International (Elsevier Publications)

ME – 247 FLUID MECHANICS

4th Semester and 2nd Year

Credit and Hours::

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- To study properties and behavior of fluids and fluid flows.
- To study means for measurement of fluid flow properties.
- To provide background for higher level subjects like Fluid Machines & Fluid power engineering.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Properties of fluid	02
2.	Fluid Statics	08
3.	Kinematics of fluid flow	08
4.	Fluid Dynamics	05
5.	Flow Measurement	04
6.	Vortex Flow	04
7.	Flow Through Pipes	04
8.	Viscous Flow	05
9.	Dimensional analysis	05

Total hours (Theory): 45

Total hours (Lab): 30

Total: 75

C. Detailed Syllabus:

1 Properties of fluid **02Hours 04%**

1.1 Introduction, classification of fluids

1.2 Study of fluid properties

2	**Fluid Statics**	**08Hours**	**18%**
2.1	Pressure at a point, center of pressure on plane and curved surface		
2.2	pressure measurement with various manometers with numerical problems		
2.3	Buoyant force, stability of submerged body and floating body.		
2.4	Meta centre & Meta centric height – analytical and experimental determination with problems		
3	**Kinematics of fluid flow**	**08Hours**	**18%**
3.1	Description of fluid flow using Langrangian and Eulerian method, Continuity equations for 2-D and 3-D flow in Cartesian coordinates of system		
3.2	Classification of fluid flows, Stream line, path line, streak line, stream tube		
3.3	Rotational and ir-rotational flow, circulation and vorticity, stream functions, velocity potential and potential flow, flow nets		
4	**Fluid Dynamics**	**05Hours**	**11%**
4.1	Euler's equation along stream tube and in Cartesian Co-ordinates		
4.2	Bernoulli's equation in one dimension flow and problems		
4.3	Momentum equation for 2-D and 3-D flow along a stream line, Kinetic energy correction and momentum correction factor		
5	**Flow Measurement**	**04Hours**	**09%**
5.1	Measurement of flow with pitot tube, venturimeter ,orifice-meter, nozzle, bendmeter		
5.2	Elementary theory of notches and weirs, flow in a curved path, pressure gradient and change of total energy across the streamlines		
6	**Vortex Flow**	**04Hours**	**09%**
6.1	Introduction , Forced Vortex flow , Free Vortex Flow		
6.2	Equation of Motion for Vortex Flow, Equation of Free &Forced Vortex Flow		
7	**Flow Through Pipes**	**04Hours**	**09%**
7.1	Loss of Energy in pipes, Frictional loss in pipe flow, Chezy's and Darcy Equation for loss of Head Due to friction in pipes		
7.2	Flow through compound, parallel and branched pipes		
8	**Viscous Flow**	**05Hours**	**11%**

8.1 Introduction, Reynolds experiment

8.2 Flow between two parallel fixed plates, Couette flow, viscous flow through pipes, Hagen – Poiseullis' equation friction factor, Moody diagram , Loss of head due to friction

8.3 Determination of coefficient of viscosity using viscometer– Capillary tube type, rotating cylinder, falling sphere, Saybolt/ Redwood viscometer

9	**Dimensional analysis**	**05Hours**	**11%**

9.1 Introduction, Fundamental dimensions, dimensional homogeneity

9.2 Rayleigh's method and Buckingham's' method

9.3 Dimensionless numbers and their significance, Hydraulic similitude, Type of models, Model testing–Model laws, Undistorted and Distorted models

D. Instructional Methods and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Student Learning Outcomes / objectives:

On successful completion of the course, the student will be able to:

1. Understand basic fluid mechanics concepts.
2. Compute the kinematical properties of a fluid element.
3. Apply Euler's and Bernoulli's equations for incompressible and in-viscid fluid flow.
4. Perform the calibration of flow meters.
5. Understand the dynamics of fluid flow and mechanics of viscous flow.
6. Analyze pipe flows and open-channel flows.
7. Perform dimensional analysis for problems in fluid mechanics.
8. Predict the results in prototype of fluid flow system by using model analysis.

F. Recommended Study Material:

Text Books:

1. Bansal R. K., “Fluid Mechanics”, Laxmi Publication
2. Rajput R. K., “Fluid Mechanics”, S. Chand & Co
3. Kumar D. S., “Fluid Mechanics and Fluid Power Engineering”, S K Kataria Publishers, New Delhi
4. Khurmi R. S. “Fluid Mechanics and Hydraulic Machines”, S. Chand & Co

Reference Books:

1. Subramanya K., “Theory and Applications of Fluid Mechanics”, Tata–McGraw Hill Publishing Co, 1993, New Delhi
2. White F. M. “Fluid Mechanics”, McGraw Hill, New York
3. Modi & Sheth, “Fluid mechanics & Hydraulic Machines”, Standard book house

web material:

1. http://www.nptel.iitm.ac.in/courses/Webcourse–contents/IIT–KANPUR/FLUID–MECHANICS/ui/About–Faculty.html

Other materials

1. Mechanical Engineering (IE)
2. Flow Measurement and Instrumentation (Elsevier Publications)
3. International Journal of Heat and Fluid Flow (Elsevier Publications)
4. Journal of Fluids and Structures (Elsevier Publications)
5. Sadhna (Engineering Sciences) www.ios.ac.in/sadhna

ME – 248 DYNAMICS OF MACHINES

4^{th} Semester and 2^{nd} Year

Credits Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	2	6	5
Marks	100	50	150	

A. Objective of the Course:

- To learn the analytical approach in the study of mechanism.
- To equip the student with fundamental knowledge of dynamics of machines so that he can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations, instrumentation and standards.
- To provide background for higher level subjects of Machines Design.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Static Force Analysis	10
2.	Dynamic Force Analysis	06
3.	Governors	10
4.	Gyroscope	08
5.	Friction	10
6.	Balancing	12
7.	Cam Dynamics	04

Total hours (Theory): 60

Total hours (Lab): 30

Total: 90

C. Detailed Syllabus:

1 Static Force Analysis **10Hours 17%**

1.1 Introduction, Basic concept of equilibrium, free body diagram

1.2 Static force analysis in various types of mechanisms by Graphical Method

1.3 Analytical and virtual Work methods

1.4 Consideration of Friction in static force analysis

2	**Dynamic Force Analysis**	**06Hours**	**10%**
2.1	D'Alemberts principle, inertia force, shaking force		
2.2	Dynamic analysis of Four–link mechanism		
2.3	Combined static and inertia force analysis of different mechanisms		
2.4	Turning – moment diagrams, fluctuation of energy, flywheels		
3	**Governors**	**10Hours**	**17%**
3.1	Types: Centrifugal, dead weight and spring controlled governors		
3.2	Controlling force, effort and power of a governor		
3.3	Sensitiveness, hunting and isochronisms in governors		
4	**Gyroscope**	**08Hours**	**13%**
4.1	Gyroscopic couple, gyroscopic stabilization of ship and vehicles		
4.2	Application of the principle of gyroscopic couple to two wheelers		
4.3	Four wheelers, planes and ships etc.		
5	**Friction**	**10Hours**	**17%**
5.1	Introduction, Kinds of friction, Laws of friction, Coefficient of friction, Surface friction		
5.2	Friction in screws with square thread and V threads, Pivot and collar friction, Rolling Friction		
6	**Balancing**	**12Hours**	**20%**
6.1	Introduction, Static and dynamic balance, Balancing of rotating masses in different planes		
6.2	Dynamics of Reciprocating Machines with Single Slider; Unbalance in Single Cylinder Engine Mechanisms		
6.3	Unbalance in Multicylinder Engines –In–line, V–twin and Radial Engines; Balancing Techniques, Field Balancing, balancing machines.		
7	**Cam Dynamics**	**04Hours**	**6%**
7.1	Analysis of circular arc cam and tangent cam, dynamics of high speed cam systems		
7.2	Polydyne cams, force analysis of cams, vibrations, jump, Shock		
7.3	Spring surge criteria in high speed cams		

D. Instructional Methods and Pedagogy

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Student Learning Outcomes / objectives:

On successful completion of the course, the student will be able to:

1. Analyze static force with graphical and analytical method for different mechanism.
2. Developed competency of graphical and analytical solution for dynamics force analysis for different mechanism.
3. Understand the high speed and polynomial cam dynamics.
4. Recognize laws of friction, rolling friction and screw friction with power screw and clutches.
5. Understand basic of balancing and procedure of balancing.
6. Analyze gyroscopic couple effect of moving body or rotating body, and its reaction in context to the motion.
7. Analyze governor selection on base of varying load and speed of an engine.

F. Recommended Study Material:

Text Books:

1. Ambekar A G, "Mechanism and Machine Theory", Jain Brothers
2. Ratan S. S., "Theory of Machines", Tata Mc Graw-Hill publications, New Delhi.
3. Ghosh Amitabha, "Theory of Mechanisms and Machines", East West Press

Reference books:

1. Rao J. S. and Dukkipati R. V. "Mechanisms and theory Machines theory", Wiley Eastern Ltd.
2. Shigley J. E and Uicker J. J., "Theory of Machines and Mechanisms", Oxford University Press.

3. Norton R. L, “Kinematics & Dynamics of Machinery “,
4. Bevan Thomas, “Theory of Machines” Tata McGraw-Hill publications, New Delhi.
5. Ballaney P L, “Theory of Machine & Mechanism”
6. Singh Sadhu, “Theory of Machines”, 2nd Ed. Pearson Education
7. Uicker John J, “Theory of Machines and Mechanism”, Oxford University Press

Web Materials

1. http://www.nptel.iitm.ac.in/

Other materials

1. Programming Languages & software’s: C, C^{++}, MATLAB , Pro Engineer
2. SADHNA (Engineering Science): http://www.ias.ac.in/sadhana/

MA – 248 NUMERICAL AND STATISTICAL METHODS

4^{th} Semester and 2^{nd} Year

Credit Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- This course is the foundation courses for Finite Element Methods, Finite Volume Methods and related courses of higher semesters in Mechanical Engineering.
- To develop more efficient and fast convergence algorithms and find better ways to control the source of errors.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Numerical Analysis and Computers	06
2.	Approximate solutions of nonlinear equations and system of linear equations	08
3.	Numerical Integration and Differentiation	08
4.	Interpolation and Polynomial Approximation	08
5.	Numerical solution of Ordinary and Partial differential equation	08
6.	Statistical Process Control and Quality Control	07

Total hours (Theory): 45

Total hours (Lab): 30

Total: 75

C. Detailed Syllabus:

1 Numerical Analysis and Computers **06 Hours 12%**

1.1 Concepts and definitions

1.2 Representation of numbers in computers, types of errors

1.3	Basic sources of errors, significant digits		
1.4	Computer arithmetic, errors in computations with digital computers		
2	**Approximate solutions of nonlinear equations and System of linear equations**	**08 Hours**	**18%**
2.1	Bisection method, Method of False position, Method of Iteration		
2.2	Newton-Raphson method for single variable		
2.3	Convergence criteria and rate of convergence and error estimates for these methods		
2.4	Direct Method: Gauss Jordan method, Crout's LU-factorization methods		
2.5	Indirect methods: Gauss Seidel and Jacobi's methods		
3	**Numerical Integration and Differentiation**	**08 Hours**	**18%**
3.1	Composite Quadrature (Newton-Cotes Quadrature)		
3.2	Romberg Integration and Gaussian Quadrature		
3.3	Remainder terms, error bounds and estimates of these rules		
3.4	Numerical Differentiation		
4	**Interpolation and Polynomial Approximation**	**08 Hours**	**18%**
4.1	Finite differences and associated operators		
4.2	Newton's Difference Interpolation		
4.3	Lagrange interpolation, Hermite interpolation		
4.4	Piecewise Interpolation: Cubic Splines		
4.5	Error estimates of these formulae		
5	**Numerical solution of Ordinary and Partial differential equation**	**08 Hours.**	**18 %**
5.1	One-Step Methods: Euler and Modified Euler Method, Runge -Kutta methods		
5.2	Finite Difference Method: Laplace's equation, Parabolic equation, Hyperbolic equation		
6	**Statistical Theory of Normal Distribution**	**07 Hours.**	**16 %**
6.1	Introduction to Normal Distributions		
6.2	History of the normal distribution		
6.3	Features of normal distributions		
6.4	Areas under Normal Distributions		
6.5	Calculations of standard deviations		

6.6 Standardization

6.7 Standard Normal Distribution and its use in computing probability

D. Instructional Methods and Pedagogy

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi–media projector, black board, etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures using MATLAB.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Student Learning Outcomes:

On successful completion of the course, the student will be able to:

1. Understand importance of number presentation in digital computer and related computations.
2. Estimate errors in numerical computations.
3. Apply algorithms of numerical solutions of equation.
4. Solve numerical integration and numerical differentiation.
5. Find numerical solution of differential equations.
6. Understand importance of Normal Probability distribution and its use in quality control.
7. Grasp, analyze, formulate and solve Numerical problems related to Mechanical Engineering.
8. Frame the fundamental algorithms/programming of Numerical analysis via programming language (MATLAB).

F. Recommended Study Material:

Text Books:

1. Sastry, S. S. Introductory methods of numerical analysis. PHI Learning Pvt. Ltd.,2012.
2. Chapra, Steven C., and Raymond P. Canale. Numerical methods for engineers. Vol. 2. New York: McGraw-Hill, 2012.
3. Montgomery, Douglas C. Introduction to statistical quality control. John Wiley & Sons, 2007.
4. Fausett L V. Applied numerical analysis using MATLAB. Pearson; 2008.

Reference books:

1. Rajaraman, Vaidyeswaran. Computer oriented numerical methods. PHI Learning Pvt. Ltd., 1993.
2. Grewal, B. S., & Grewal, J. S. Numerical Methods in Engineering & Science: With Programs in C, C++ & MATLAB. Khanna, 2014.
3. Allen, Theodore T. Introduction to engineering statistics and six sigma: statistical quality control and design of experiments and systems. Springer Science & Business Media, 2006.
4. Khandelwal, Anju. Computer Based Numerical & Statistical Techniques. New Age International, 2009.
5. Dukkipati, Rao V. MATLAB: An Introduction with Applications. New Age International, 2010.
6. Gilat, Amos. MATLAB: An introduction with Applications. John Wiley & Sons, 2009.

Reading Materials, web materials with full citations:

1. http://numericalmethods.eng.usf.edu, http://nptel.ac.in
2. http://mathworld.wolfram.com/

HS – 133A CREATIVITY, PROBLEM SOLVING AND INNOVATION

4th Semester and 2nd Year

Credit Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	100		100	

A. Objective of the Course:

To facilitate learners to:

- gain familiarity with the mechanics of creativity and problem solving
- develop an attitude for innovation
- develop creative thinking skills using cone of learning components leading to understanding of strategies of creativity, problem solving and innovation
- explore applications of the concepts of creativity and problem solving skills in personal, social, academic, and profession life.

B. Outline of the Course:

Module No.	Title/Topic	Classroom Contact Hours
1	**Introduction to Creativity, Problem Solving and Innovation** • Definitions of Creativity and Innovation • Need for Problem Solving and Innovation • Scope of Creativity in various Domains • Types and Styles of Thinking • Strategies to develop Creativity, Problem Solving and Innovation skills	06
2	**Questioning, Learning and Visualization** • Strategy and Methods of Questioning • Asking the Right Questions • Strategy of Learning and its Importance • Sources and Methods of Learning • Purpose and Value of Creativity Education in real life • Visualization strategies - Making thoughts Visible • Mind Mapping and Visualizing Thinking	06

3	**Creative Thinking and Problem Solving** • Creative Thinking and its need • Strategy of Thinking Fluency • Generating all Possibilities • SCAMPER Technique • Divergent Vs Convergent Thinking • Lateral Vs Vertical Thinking • Fusion of Ideas for Problem Solving • Applying strategies for Problem Solving	06
4	**Logic, Language and Reasoning** • Basic Concepts of Logic • Statement Vs Sentence • Premises Vs Conclusion • Concept of an Argument • Functions of Language: Informative, Expressive and Directive • Inductive Vs Deductive Reasoning • Critical Thinking & Creativity • Moral Reasoning	06
5	**Contemporary Issues and Practices in Creativity and Problem Solving** • Cognitive Research Trust Thinking for Creatively Solving Problems • Case Study on Contemporary Issues and Practices in Creativity and Problem Solving	06
	Total	30

C. Instruction Methods and Pedagogy

The course is based on practical learning. Teaching will be facilitated by Slides Presentations, Reading Material, Discussions, Case Studies, Puzzles, Ted Talks, Videos, Task-Based Learning, Projects, Assignments and various Individual and Interpersonal activities like, Critical reading, Group work, Independent and Collaborative Research, Presentations, etc.

D. Evaluation:

There will be no end semester university examinations. Students will be evaluated continuously in the form of internal as well as external evaluation. The evaluation is schemed as 30 marks for internal evaluation and 70 marks for external evaluation. The concerned teacher shall evaluate students distribute the marks (out of 30 as Internal and out of 70 as External) and submit them.

Evaluation Scheme

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sr. No.	Component	Number	Marks per incidence	Total Marks
1	Attendance	100 %	--	20
2	Individual Activity Participation	As stipulated by the Resource Person(s) in the Training		20
3	Group Activity Participation			20
4	Presentation			30
5	Feedback on Improvement			10
			Total	**100**

E. Learning Outcomes

On successful completion of the course, the student will be able to:

1. Demonstrate creativity in their day to day activities and academic output
2. Solve personal, social and professional problems with a positive and an objective mindset
3. Think creatively and work towards problem solving in a strategic way
4. Initiate new and innovative practices in their chosen field of profession

F. Reference Books / Reading

Text Books

1. R Keith Sawyer, Zig Zag, The Surprising Path to Greater Creativity, Jossy-Bass Publication 2013
2. Michael Michalko, Crackling Creativity, The Secrets of Creative Genus, Ten Speed Press 2001

Reference Books

3. Michael Michalko, Thinker Toys, Second Edition, Random House Publication 2006
4. Edward De Beno, De Beno's Thinking Course, Revised Edition, Pearson Publication 1994
5. Edward De Beno, Six Thinking Hats, Revised and Update Edition, Penguin Publication 1999
6. Tony Buzan, How to Mind Map, Thorsons Publication 2002
7. Scott Berkum, The Myths of Innovation, Expended and revised edition, Berkun Publication 2010
8. Tom Kelly and David Kelly, Creative confidence: Unleashing the creative Potential within Us all, William Collins Publication 2013
9. Ira Flatow, The all Laughed, Harper Publication 1992
10. Paul Sloane, Des MacHale & M.A. DiSpezio, The Ultimate Lateral & Critical Thinking Puzzle book, Sterling Publication 2002

11. *Additional Readings*
12. Keith Sawer, Group Genius, The Creative Power of Collaboration, Basic Books Publication 2007
13. Edward De Beno, Lateral Thinking, Creativity Step by Step, Penguin Publication 1973
14. Nancy Margulies with Nusa Mall, Mapping Inner Space, Crown House Publication 2002
15. Tom Kelly with Jonathan Littman, The Art of Innovation, Profile Publication 2001
16. Roger Von Oech, A Whack on the Side of the Head. Revised edition, Hachette Publication 1998
17. Roger Von Oech, A Kick in the Seat of the Head, William Morrow 1986
18. Jonah Lehrer, Imagine How Creativity Works, Canongate Books Publication 2012
19. James M Higgins, 101 Creative Problem Solving Techniques, New Management Publication 1994
20. Soctt G Isaksen, K Brain Doval, Donald J Treffinger, Creative Approach to Problem Solving, Sage Publication 2000
21. Donald J Treffinger, scott G Isaksen, K Brain stead Dorval Creative Problem Solving An Introduction, Prufrock Press 2006
22. H Scott Fogler & Steven E. LeBlance, Strategies for Creative Problem Solving, Prentice Hall Publication 2008
23. Dave Gray, Sunni Brown and James Macanufo, Game Storming, O'reilly Publication 2010.
24. Howard Gardner, Creating minds, Basic Books Publication 1993
25. Mihaly Csikzentmihalyi, Creativity–Flow and Psychology of Discovery and Invention, Harper Publication 1996
26. Martin Gerdner, W. H., Ahal Insight, Freeman Publication 1978
27. Paul Sloane, Test Your Lateral Thinking IQ, Sterling Publication1994
28. Paul Sloane & Des Machale Intriguing, Lateral Thinking Puzzles, Sterling Publication 1996

Articles / Videos / Other Suggested Materials

- Internet Search based May TED talks and other sources for videos, slide shares, problems, etc

B. Tech. (Mechanical Engineering) Programme

SYLLABI

University Elective Courses

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
List of University Elective Courses under
Choice Based Credit System
Second Year Undergraduate Programme
(Effective from Academic year 2017-18)

Sr. No.	Course Code & Course Name	Department / Faculty offering the Course	Semester in which the course to be offered / Remarks
1	EC281.01: Introduction to MATLAB Programming	EC / FTE	3
2	EC282.01: Prototyping Electronics with Arduino		4
3	CE281.01: Art of Programming	CE / FTE	3
4	CE282.01: Web Designing		4
5	CL281.01: Environmental Sustainability and Climate Change	CL / FTE	3
6	CL282.01: Basics of Environmental Impact Assessment		4
7	EE283: Python For Electrical Engineering	EE/FTE	3
8	EE286: Computer Programming For Electrical Engineering		4
9	IT281.01: ICT Resources and Multimedia	IT/FTE	3
10	IT282.01: Internet Technology and Web Design		4
11	ME281.01: Engineering Drawing	ME/FTE	3
12	ME282.01: Material Science		4
13	PH233.01: Fundamentals of Packaging	RPCP/FPH	3
14	PH238.01: Cosmetics in daily life		4
15	PD260.01: Basic Laboratory Techniques	PDPIAS/FAS	
16	NR251.01: First Aid & Life Support	NURSING / FMD	3
17	NR261.01: Life Style Diseases & Management		4
18	PT191.01: Health Promotion and Fitness	ARIP / FMD	3
19	PT192.01: Occupational Health & Ergonomics		4
20	CA224: Introduction to Web Designing	CMPICA / FCA	3
21	CA225: Programming the Internet		4
22	BM231: Banking and Insurance	I^2IM / FMS	3
23	BM241: Health Care Management		4
24	PD261: Astrophysics Space and Cosmos-I		3
25	PD262: Astrophysics Space and Cosmos- II		4

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF TECHNOLOGY & ENGINEERING
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
EC281.01: INTRODUCTION TO MATLAB PROGRAMMING
B TECH 3rd SEMESTER (UNIVERSITY ELECTIVE)

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	00	100	100	

A. **Objective of the Course:**

The course, intended for students with no programming experience, provides the foundations of programming in MATLAB. Variables, arrays, conditional statements, loops, functions, and plots are covered. At the end of the course, students should be able to use MATLAB in their own work and be prepared to deepen their MATLAB programming skills and tackle other programming languages.

B. **Outline of the Course:**

Sr. No.	Title of the Unit	Minimum Number of Hours
1.	Introduction to MATLAB Basics	3
2.	Basic MATLAB Functions	8
3.	Interactive computation	8
4.	Scripts and Functions in MATLAB	8
5.	Applications	3

Total Hours (Theory): 30

Total Hours (Lab): 0

Total Hours: 30

C. Detailed Syllabus:

1.	**Introduction to MATLAB Basics**	**3 Hours**	**10%**
1.1	MATLAB windows, On-line help		1Hr
1.2	Input- Output, File Types		1 Hr
1.3	General commands to remember		1 Hr

2.	**Basic MATLAB Functions**	**8 Hours**	**25%**
2.1	Working with Arrays of Number		1Hr
2.2	Creating and Printing Simple Plots		1Hr
2.3	Creating, Saving, and Executing a Script File		2Hrs
2.4	Creating and Executing a Function File		2Hrs
2.5	Working with Files and Directories		2Hrs
3.	**Interactive computation**	**8 Hours**	**25%**
3.1	Matrix and Vectors		1Hr
3.2	Matrix and Array Operations		3Hrs
3.3	Creating and Using Inline Functions		2Hrs
3.4	Using Built in Functions		2Hrs
4.	**Scripts and Functions in MATLAB**	**8 Hours**	**25%**
4.1	Scripts Files		2Hrs
4.2	Function Files		3Hrs
4.3	Language-Specific Features		3Hrs
5.	**Applications**	**3 Hours**	**15%**
5.1	Solving a Linear system		1Hr
5.2	Finding eigenvalues and eigenvectors		1 Hr
5.3	Matrix Factorizations		1 Hr

D. Instructional Methods and Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

<table>
<tr><th>Evaluation</th><th colspan="2">Marks</th><th>Evaluation Methodology</th></tr>
<tr><td>External</td><td colspan="2">70 Marks</td><td>Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.</td></tr>
<tr><td rowspan="2">Internal</td><td>30 Marks</td><td>5 Marks for Attendance</td><td>N/A</td></tr>
<tr><td></td><td>25 Marks for Continuous Evaluation</td><td>Quiz; Assignments, Seminars, Projects, Presentation, etc.</td></tr>
</table>

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

E. Student Learning Outcomes:

Students will acquire the following skills:

- Be fluent in the use of procedural statements--assignments, conditional statements, loops, function calls--and arrays.
- Be able to design, code, and test small MATLAB programs that meet requirements expressed in English. This includes a basic understanding of top-down design.

F. Recommended Study Materials

Reference Book & Text Book:

1. Getting Started with MATLAB, Rudrapratap (IISc, Banglore), Oxford University Press.
2. A Guide to MATLAB, Brian R Hunt, Ronald L Lipsman, Cambridge University Press.

Web Materials / Reading Materials:

1. Lecture notes
2. Handouts
3. Chapter wise Assignment

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF TECHNOLOGY & ENGINEERING
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
EC282.01: PROTOTYPING ELECTRONICS WITH ARDUINO
B TECH 4^{th} SEMESTER (UNIVERSITY ELECTIVE)

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	00	100	100	

A. **Objective of the Course:**

- To aware students regarding Arduino Architecture
- To aware students regarding peripherals, sensors, wireless devices interfacing & Programming

B. **Outline of the Course:**

Sr. No.	Title of the Unit	Minimum Number of Hours
1.	Getting Started with Arduino	02
2.	Arduino C	06
3.	GPIO Programming	08
4.	Sensors & Actuators	06
5.	Wireless Devices	08

Total Hours (Theory):30

Total Hours (Lab): 00

Total Hours: 30

C. Detailed Syllabus:

1.	**Getting Started with Arduino**	**02 Hours**	**10%**
1.1	Introduction to Arduino		1 Hr
1.2	Arduino Variants		
1.3	The Arduino UNO Board		1 Hr
1.4	Electronics Components		
2.	**Arduino**	**06 Hours**	**20%**
2.1	C Data types		2 Hrs

2.2	Control Statements		
2.3	Functions & Arrays		
2.4	Using Modifying & Creating Arduino Libraries		2 Hrs
2.5	Advanced Coding & Memory Handling in Arduino		2 Hrs
3.	**GPIO Programming**	**08 Hours**	**25%**
3.1	LED Interfacing with Arduino		1 Hr
3.2	Driving 7 Segment Display using Arduino		1 Hr
3.3	Serial Communications & Soft serial Utility		2 Hrs
3.4	LCD Interfacing using Arduino		1 Hr
3.5	Matrix Keypad Interfacing using Arduino		1 Hr
3.6	Controlling Speed of DC Motor using PWM Techniques		1 Hr
3.7	Driving Stepper Motor using Arduino		1 Hr
4.	**Sensors & Acuators**	**06 Hours**	**20%**
4.1	Introduction to Sensors & Actuators		2 Hrs
4.2	Digital On/Off Sensors		
4.3	Analog Sensors		2 Hrs
4.4	Pulse Sensors		2 Hrs
5.	**Wireless Devices**	**08 Hours**	**25%**
5.1	Introduction to Wireless Devices		2 Hrs
5.2	Interfacing GSM & GPS Module with Arduino		
5.3	Interfacing Bluetooth Module with Arduino		2 Hrs
5.4	Interfacing Zigbee Module with Arduino		2 Hrs
5.5	Interfacing IR Module with Arduino		2 Hrs

D. Instructional Methods and Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

<table>
<tr><td>Evaluation</td><td colspan="2">Marks</td><td>Evaluation Methodology</td></tr>
<tr><td>External</td><td colspan="2">70 Marks</td><td>Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.</td></tr>
<tr><td rowspan="2">Internal</td><td rowspan="2">30 Marks</td><td>5 Marks for Attendance</td><td>N/A</td></tr>
<tr><td>25 Marks for Continuous Evaluation</td><td>Quiz; Assignments, Seminars, Projects, Presentation, etc.</td></tr>
</table>

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

E. Student Learning Outcomes

- Upon completion of this course, students will understand the Arduno Architecture.
- Students can understand the programming GPIOs, Sensors, Actuators & Wireless Devices.

F. Recommended Study Materials

Reference Book & Text Book:

3. Beginning of Android ADK with Arduino by Mario
4. Arduino CookBook, Michael Margolis, O'Reilly

Web Materials / Reading Materials:

1. Lecture notes
2. Handouts
3. Chapter wise Assignment

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF TECHNOLOGY & ENGINEERING
U & P U. PATEL DEPARTMENT OF COMPUTER ENGINEERING
CE281.01: ART OF PROGRAMMING
B TECH 3RD SEMESTER (UNIVERSITY ELECTIVE)

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	00	100	100	

A. **Objective of the Course:**

- To be able to understand the various data structures available in programming language and apply them in solving computational problems.
- To be able to do testing and debugging of code written programming language.
- To create students' interest for programming related subjects and to make them aware of how to communicate with computers by writing a program.
- To foster the ability of solving various analytical and mathematical problems with algorithms within students.
- To make them learn regarding different data structures and memory management in the programming language.
- To promote skills like Development of logic and implementation of basic mathematical and other problems at individual level.
- To make them learn and understand coding standards, norms, variable naming conventions, commenting adequately and how to form layout of efficient program.
- To explain them concepts of pointer & file management concepts.

B. **Outline of the Course:**

Sr. No	Title of the Unit	Minimum number of Hours
1.	Introduction to Computer Systems	02
2.	Data Storage and Operations	03
3.	Algorithms and Flow charting	04
4	Algorithm to Program	06
5	Loops and Controls Construct	04
6	Errors and Debugging	04
7	Structured Programming	04
8	Coding Conventions	03

Total Hours (Theory):30

Total Hours (Lab): 00

Total Hours: 30

C. Detailed Syllabus:

1.	**Introduction to Computer Systems**	02 Hours	7%
1.1	Basic computer organisation, operating system, editor, compiler, interpreter, loader, linker, program development.		
2.	**Data Storage and Operations**	03 Hours	10%
	Various data representation techniques, data types, constants, variables (local and global), arrays, various arithmetic and logical operations in a typical programming environment, working with numbers, String and operators, finding pattern in string.		
3.	**Algorithms and Flow charting**	04 Hours	13%
	Introduction to computer problem solving, concepts and algorithms and flow chart, tracing of an algorithms, writing conditional code.		
4	**Algorithm to Program**	06 Hours	21%
	Specifications, top down development and stepwise refinement as per programming environment needs. Imperative style of correct and efficient programming, introductory concepts of time and space complexities.		
5	**Loops and Controls Construct**	04 Hours	13%
	Conditional and unconditional execution. Simple versus nested controls. Various aspects of repetitive executions, iterative versus recursive programming styles, assertions and loop invariants.		
6	**Errors and Debugging**	04 Hours	13%
	Types of errors, error handling, debugging, tracing/stepwise execution of program, watching variables values in memory.		
7	**Programming**	04 Hours	13%
	Introduction to modular approach of problem solving, concepts of procedure and functions for effective programming, Making code modular.		
8	**Coding Conventions**	03 Hours	10%
	Variable naming, function naming, indentation, usage and significance of comments for readability and program maintainability.		

D. Instructional Methods and Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks		Evaluation Methodology
External	70 Marks		Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

F. Student Learning Outcomes

- Students will get acquainted with basic components and capabilities of a typical computing system.
- Students will be able to critically think about basic problems and develop algorithms to solve, validate and verify with computing systems.
- Students will be able to identify appropriate language constructs and approach to computational problems.
- Students will be acquainted with coding standards including documentation which are required to be used for the development of effective, efficient and maintainable programs.

F. Recommended Study Materials

Reference Book & Text Book:

1. Joyce Farrell, Programming Logic and Design Comprehensive, Cenage Learning
2. Sedgewick R., Algorithms in C, Addison Wesley
3. V. Rajaraman, Fundamentals of Computers, Prentice Hall of India

Web Materials / Reading Materials:

1. Lecture notes
2. Handouts
3. Chapter wise Assignment

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF TECHNOLOGY & ENGINEERING
U & P U. PATEL DEPARTMENT OF COMPUTER ENGINEERING
CE282.01: WEB DESIGNING
B TECH 4th SEMESTER (UNIVERSITY ELECTIVE)

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	00	100	100	

A. Objective of the Course:

- To learn how to link pages so that they create a Web site.
- To Design and develop a Web site using text, images, links, lists, and tables for navigation and layout.
- To style web page using CSS, internal style sheets, and external style sheets.
- To learn how to use graphics in Web design.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Web Designing Principles	02
2	Basic of Web Designing	03
3	Hyper Text Markup Language	06
4	Cascading Style Sheet Language	06
5	Extensible Mark-up Language	04
6	Adobe Dreamweaver	03
7	Adobe Photoshop	06

Total Hours (Theory):30

Total Hours (Lab): 00

Total Hours: 30

C. Detailed Syllabus:

1.	**Web Designing Principles**	**02 Hours**	7%
	Basic principles involved in developing a web site, Planning process, Five Golden rules of web designing, Designing navigation bar, Page Design, Home Page Layout, Design Concept		
2.	**Basic of Web Designing**	**03 Hours**	10%
	Brief History of Internet, What is World Wide Web, Why create a web site, Web Standards and Protocols		
3.	**Hyper Text Markup Language**	**06 Hours**	20%
	Basic structure of an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, HTML Tags and Attributes , Creating an HTML layout		
4	**Cascading Style Sheets**	**06 Hours**	20%
	Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling(Background, Text Format, Controlling Fonts), CSS Id and Class, CSS Selectors, Box Model(Introduction, Border properties, Padding, Properties, Margin properties)		
5	**Extensible Mark-up Language**	**04 Hours**	13%
	Basics of XML, XML Attribute, Elements, XML Validator		
6	**Adobe Dreamweaver**	**03 Hours**	10%
	Setting Up a Site with Dreamweaver, FTP - Site Upload Feature of Dreamweaver, Create various types of Links, Insert multimedia including text, image, animation & video		
7	**ADOBE Photoshop**	**06 Hours**	20%
	Use of selection tools, Drawing and Painting tool, Transform B/W image to color, Layers, moving layer content using move tool Manipulating Images		

D. Instructional Methods and Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks		Evaluation Methodology
External	70 Marks		Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

G. Student Learning Outcomes

Upon successful completion of this course, the student will:

- Create an Information Architecture document for a web site.
- Select and apply mark-up languages for processing, identifying, and presenting of information in web pages.
- Combine multiple web technologies to create web components.
- Incorporate best practices in navigation, usability and written content to design websites that give users easy access to the information they seek.

F. Recommended Study Materials

Reference Book & Text Book:

1. Html And CSS: Design And Build Websites, By Jon Duckett.
2. Learning Web Design: A Beginner's Guide To Html, Css, Javascript, And Web Graphics, By Jennifer Niederst Robbins
3. Beaird, Jason. 2010. The Principles Of Beautiful Web Design. 2nd Edition. Isbn-10: 098057689x
4. Adobe Dreamweaver Cs6: Classroom In A Book

Web Materials / Reading Materials:

1. Lecture notes
2. URLs such as

   https://www.w3.org/

   http://www.land-of-web.com/category/tutorials

   http://www.bypeople.com/design-trends-for-2011/

   https://www.w3schools.com/

   https://www.html5rocks.com/en/

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF TECHNOLOGY & ENGINEERING
MANUBHAI S. PATEL DEPARTMENT OF CIVIL ENGINEERING
CL281.01: ENVIRONMENTAL SUSTAINABILITY AND CLIMATE CHANGE
3RD SEMESTER (UNIVERSITY ELECTIVE)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	00	100	100	

A. Objectives of the Course:

The main objectives of the course are:

- To provide a basic understanding of the major environmental problems that need to be addressed to ensure sustainable development
- To provide a basic understanding about various management approaches towards a sustainable development
- To introduce students to the environmental aspects of specific industrial sectors, such as energy, transport, land and water use, and the built environment
- To provide basic understanding about climate changes, their causative factors and the possible mitigation

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introducing Sustainability Basics and Environmental Management	03
2	Environmental Challenges	03
3	Principles of Environmental Management	08
4	Environmental Sustainability	04
5	Introduction to Climate Change	07
6	Climate Change-Mitigation	05

Total Hours (Theory): 30

Total Hours (Lab): 00

Total Hours: 30

C. Detailed Syllabus:

1	**Introducing Sustainability Basics and Environmental Management**	**03 Hours**	**10%**
1.1	What is Unsustainable?		
1.2	What is Sustainability? Defining the Terms		
1.3	Development & Environment		
1.4	Environmental Strategy: The New Business Playing Field		
1.5	Environmental Management		
2	**Environmental Challenges**	**03 Hours**	**10%**
2.1	Depletion of Water Resources		
2.2	Population		
2.3	Agriculture		
2.4	Land Degradation		
2.5	Energy Security		
3	**Principles of Environmental Management**	**08 Hours**	**26%**
3.1	Environmental Concerns in India		
3.2	International Environmental Movement		
3.3	Definition, Goals, Need, Tools of Environmental Management		
3.4	Participants in EM		
3.5	Ethics and the Environment		
3.6	Ecology and the Environment		
3.7	Environmental Management Systems & Standards		
4	**Environmental Sustainability**	**04 Hours**	**14%**
4.1	Strategies for Sustainability		
4.2	Land Use and Urban Planning		
4.3	Energy and Climate Change		
4.4	Transportation		
4.5	Balancing Population with Food and Water Resources		
5	**Introduction to Climate Change**	**07 Hours**	**23%**
5.1	Climate Change-Way & Means		
5.2	What Do We Know and Don't Know?		
5.3	The Physical Science of Climate Change		
5.4	Causes of Climate Change		
5.5	Global Atmospheric Composition		
5.6	Greenhouse Gases and Aerosols		
5.7	Extreme Weather Events & Sea Level Rise		
5.8	Climate Projections and their Uncertainties		

6 Climate Change-Mitigation **05 Hours** **17%**

6.1 Global Carbon Cycle

6.2 Concept of Carbon Sequestration

6.3 Carbon Credits and Carbon Footprints

6.4 Policy Perspective: UNFCC, IPCC, Kyoto Protocol, MoEFCC

D. Instructional Method and Pedagogy:

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks		Evaluation Methodology
External	70 Marks		Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

E. Students Learning Outcomes:

On the completion of the course the students will be able to:

- Understand & appreciate for the value of quantitative, systems and trans disciplinary thinking of Environmental Sustainability
- Expand their awareness about the environment as an increasing part of the core business model and day-to-day operations of many organizations
- Develop an environmental blueprint for action
- Think strategically and act entrepreneurially to create sustainable future
- Review on Climate Change and related strategies

F. Recommended Study Materials:

Text Books:

1. Environmental Management, T. V. Ramchandra & Vijay Kulkarni, Teri Press, New Delhi, 2009.

2. Handbook of Environmental Laws, Acts, Guidelines, Compliances & Standard Policy, R. K. Trivedy, B.S. Publishers, 2010.
3. Climate Change & India, Vulnerability Assessment and Adaption, P. R. Shukla, University Press, Hyderabad, 2003.

Reference Books:

1. Environmental Management, Principles and Practice, C. J. Barrow, Psychology Press, 1999.
2. Environmental Management in Practice, Nath B., Hens, L., Compton, P. and Devuyst, D, Vol I, Routledge, London and New York, 1998.
3. Handbook of Environmental Management and Technology: Gwendolyn Holmes, Ben Ramnarine Singh, and Louis Theodore, Wiley, 2004.
4. Corporate Environmental Management: Welford R, University Press, Hyderabad, 1999.

Web Materials:

1. http://nptel.ac.in/courses/122102006/7
2. http://envfor.nic.in/
3. http://cpcb.nic.in/
4. http://gpcb.gov.in/
5. http://nptel.ac.in/courses/119106008/40
6. https://unccelearn.org/course/
7. http://www.open.edu/openlearn/nature-environment/the-environment/climate-change/content-section-0
8. http://www.openlearningworld.com/

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF TECHNOLOGY & ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING

EE283: PYTHON FOR ELECTRICAL ENGINEERING

3rd Semester and 2nd Year (Level II)

Credit Hours:

Teaching Scheme	Theory	Practical	Total
Hours/week	-	2	2
Marks	-	100	100

A. Objective of the Course:

In this world of digitization, as an electrical engineer it is very important to opt for a precise computational alternative. The objectives of the course are:

- To introduce the students with the fundamentals and detail knowledge of Python. (1, 4, 5)
- To learn how to develop the program using basic commands of Python. (2, 4,6)
- To develop programs and user de
- fined algorithms to provide optimized output. (1,5,6,7)
- Ability to perform and develop different computational skills using software recognized worldwide. (3,6)
- To Learn how to implement this computational techniques in solving problems of power system. (9)
- To be able to participate in Python based coding competition. (11)

B. Examination Scheme:

Theory Marks		Practical Marks		Total Marks
Internal	External	Internal	External	
-	-	25	25	50

C. Outline of the Course:

Sr. No.	Title of Units	Number of Hours
1	Variables and type	05
2	Function, Basic recursion	05
3	Control flow: Branching and repetition	05
4	Introduction to objects: Strings and lists	05

5	Python modules, debugging programs	05
6	Introduction to data structures : Dictionaries	05

Total Hours: 30

D. Revised Bloom's Taxonomy

The below specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary from the below table.

level					
Remembrance	Understanding	Application	Analyze	Evaluate	Create
05	15	20	20	25	15

F. **Course Outcomes (Learning Outcomes):**

Upon successful completion of this course, a student will be able to

- Students will be aware about the use of Python for various problem solving.
- To strengthen the fundamentals of mathematics
- To enhance the programming skills in Python for electrical engineering.

G. **Instructional Methods and Pedagogy**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Laboratories will be conducted with the aid of multimedia projector.
- A student has to prepare a laboratory term work as per instruction given by lab instructor.
- A student has to prepare a laboratory term work as per instruction given by lab instructor.
- Attendance is compulsory in laboratory, which carries five marks of the overall evaluation.
- Two viva voce will be conducted during the semester and average of two will be considered as a part of overall evaluation.

H. **Recommended Study Material:**

Text Books:

1. Think Python – How to Think like a Computer Scientist, Allen Downey, Green Tea Press.

Reference Books:

1. Python Programming: A Complete Guide for Beginners to Master, Python Programming Language , Brian Draper
2. Python: The Complete Reference, Martin C. Brown, Tata McGraw Hill

Web Material:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016
2. https://www.python.org/about/gettingstarted
3. https://onlinecourses.nptel.ac.in/noc18_cs21/preview

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF TECHNOLOGY & ENGINEERING
MANUBHAI S. PATEL DEPARTMENT OF CIVIL ENGINEERING
CL282.01: BASICS OF ENVIRONMENTAL IMPACT ASSESSMENT
4TH SEMESTER (UNIVERSITY ELECTIVE)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	00	100	100	

A. Objectives of the Course:

The main objectives of the course are:

- To provide a basic understanding of the need, objective and the parameters considered for Environmental Impact Assessment (EIA) studies
- To provide an awareness on impact on resources and environment from development projects
- To introduce students to the legal, economic, administrative and technical process of preparing and/or evaluating environmental impact documents
- To learn laws related to EIA and auditing in India

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to EIA	05
2	Considerations for Environmental Assessment	07
3	Process of Impact Assessment	07
4	Tools for Assessing Environmental Impact	07
5	EIA in Indian Scenario	04

Total Hours (Theory): 30

Total Hours (Lab): 00

Total Hours: 30

C. Detailed Syllabus:

1	**Introduction to Environmental Impact Assessment**	**05 Hours**	**17%**
1.1	What is EIA?		
1.2	Objectives of EIA		
1.3	Brief History of Environmental Impact Analysis,		
1.4	EIA as research,		
1.5	EIA as decision making process,		
1.6	EIA in Global Affairs		
2	**Considerations for Environmental Assessment**	**07 Hours**	**23%**
2.1	Assessment Methodology		
2.2	Socioeconomic Impact Assessment		
2.3	Air Quality Impact Analysis		
2.4	Noise Impact Analysis		
2.5	Energy Impact Analysis		
2.6	Water Quality Impact Analysis		
2.7	Vegetation And Wild Life Impact Analysis		
2.8	Cumulative Impact Assessment		
2.9	Ecological Impact Assessment		
2.10	Risk Assessment		
3	**Process of Impact Assessment**	**07 Hours**	**23%**
3.1	Process for Environmental Impact Study		
3.2	Terms of Reference		
3.3	Stages in EIS Production: Screening, Scoping, Prediction, Evaluation, Reducing Impact, Monitoring, Conclusions		
3.4	Components of EIA Reports		
4	**Tools for Assessing Environmental Impact**	**07 Hours**	**23%**
4.1	Impact Assessment Methodologies - various Methods - Their Applicability		
4.2	Rapid EIA		
4.3	Strategic Impact Assessment		
4.4	Cumulative Impact Assessment		
5	**EIA in Indian Scenario**	**04 Hours**	**14%**
5.1	Provisions in the EIA Notification by MoEFCC		
5.2	Categorization of Industries for Seeking Environmental Clearance		
5.3	Procedure for Environmental Clearance		
5.4	Environmental Management Plan		
5.5	Case Study: Sardar Sarovar Dam, Narmada Project		

D. **Instructional Method and Pedagogy:**

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks		Evaluation Methodology
External	70 Marks		Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

E. **Students Learning Outcomes:**

On the completion of the course the students will be able to:

- Decide on the typical parameters to be considered in a EIA study of a developmental project
- Fully participate in interdisciplinary environmental report preparation teams
- Review and understand an EIA document for completeness and adequacy
- Review a typical development project plan and identify possible environmental effects and prepare appropriate initial studies
- Utilize EIA documents for policy development, project planning or for legal or political action planning

F. **Recommended Study Materials:**

Text Books:

1. Environmental Impact Assessment, Larry W Canter (2nd Edition), McGraw Inc., Singapore, 1996.
2. Environmental Impact Assessment – Handbook: John G Rau and D C Wooren, Mc-GrawHill.
3. Environmental Impact Assessment, A. K. Shrivastava, APH Publishing, New Delhi, 2003.

Reference Books:

1. Eccleston, H.C. Environmental Impact Statements. John Wiley & Sons, Inc. Canada, 2000.

2. World Bank, Environmental Assessment Sourcebook. Volume 1. World Bank Technical Paper No. 139, Washington, D.C, 1991.
3. Environmental Impact Analysis - a Decision Making Tool: By R K Jain, L. V. Urban and G.S. Stacey Publishers: Van Nostrand Reinhold New York.

Web Materials:

1. http://eia.unu.edu/course/index.html%3Fpage_id=173.html
2. http://envfor.nic.in/legis/eia/eia-2006.htm
3. http://envfor.nic.in/
4. http://nptel.ac.in/Clarify_doubts.php?subjectId=120108004&lectureId=5
5. http://cpcb.nic.in/
6. http://gpcb.gov.in/

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF TECHNOLOGY & ENGINEERING
DEPARTMENT OF INFORMATION TECHNOLOGY
IT281.01: ICT RESOURCES AND MULTIMEDIA
3RD SEMESTER (UNIVERSITY ELECTIVE)

Credits and Hours:

<table>
<tr><th>Teaching Scheme</th><th>Theory</th><th>Practical</th><th>Total</th><th>Credit</th></tr>
<tr><td>Hours/week</td><td colspan="2">2</td><td>2</td><td rowspan="2">2</td></tr>
<tr><td>Marks</td><td>00</td><td>100</td><td>100</td></tr>
</table>

A. Objective of the Course:

The main objectives for offering the course ICT RESOURCES AND MULTIMEDIA are:

1. To provide you the conceptual and technological developments in the field of information technology with the emphasis on comprehensive knowledge of Internet.
2. To introduce the fundamental elements of multimedia.
3. Understand to use the packages of presentation in detail.
4. Understand the impact of Information Technology on the Society and Various applications.

B. Outline of the Course

Sr. No.	Title of the Unit	Minimum Number of Hours
1	ICT Utilities and Tools	8
2	Introduction to Multimedia	4
3	Presentation Package	6
4	Networking Concepts	6
5	Information Technology and Society	6

Total hours (Theory): 30
Total hours (Lab): 00
Total hours: 30

C. **Detailed Syllabus:**

Following contents will be delivered to the students during laboratory sessions.

1.	**ICT Utilities and Tools**	**08 Hours**	**30%**

Compression Utilities: WinZip, PKZIP, Concept of compression, Defragmenting Hard, disk using defrag, Scan Disk for checking disk space, lost files and recovery, Formatting Hard disk, Setting System Date and Time, Antivirus.

Tools: Prezi, Macromedia Director & Flash, Gliffy, Edmodo, Google Classroom, Glogster.

2.	**Introduction to Multimedia**	**04 Hours**	**10 %**

What is multimedia, Components of multimedia, Web and Internet multimedia applications, Transition from conventional media to digital media.

3.	**Presentation Package**	**06 Hours**	**20%**

Microsoft PowerPoint: Slide layout, Slide design (Proper selection based on audience), Header and Footer in slides, Slide transition, Slide Master, Insert Picture-Smart Art, Insert animations to different objects, Hide Slide, Rehearse Timings, Record slide show. How to prepare professional presentation.

4.	**Networking Concepts**	**06 Hours**	**20%**

What is Networking, Local Area Networking (LANs), Metropolitan Area Network , MAN), Wide Area Network (WAN), Networking Topologies, Transmission media & method of communication.

5.	**Information Technology and Society**	**06 Hours**	**20%**

Indian IT Act, Intellectual Property Rights – issues. Application of information Technology in Railways, Airlines, Banking, Insurance, Inventory Control, Financial systems, Hotel management, Education, Video games, Telephone exchanges, Mobile phones, Information kiosks, special effects in Movies.

D. Instructional Method and Pedagogy:

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks		Evaluation Methodology
External	70 Marks		Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

E. Student Learning Outcomes:

At the end of the course the students will be able to:

- A student will be having the basic knowledge of the Information Technology.
- A student will be able to understand effectively use miscellaneous utilities such as: Compression, CD writing, Antivirus etc.
- A student will be able to use different tools for analysis and presentation.
- A student will be able to know the impact of ICT tools and Information Technology in Society.

F. Recommended Study Material:

Text Books:

- ITL Educational Society, "Introduction to IT", Pearson Education, 2009.
- William Stallings, "Data and Computer Communication", Prentice, Hall of India Private Limited.
- Mavis Beacon, "All-in-one MS Office" CD based views for self-learning, BPB Publication, 2008
- Li & Drew, "Fundamentals of Multimedia", Pearson Education, 2009.

Reference Books:

- Tay Vaughan, "Multimedia making it work", Tata McGraw-Hill, 2008.
- Parekh Ranjan, "Principles of Multimedia", Tata McGraw-Hill, 2007.

Web Materials:

- https://www.tutorialspoint.com
- http://computingcareers.acm.org

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF TECHNOLOGY & ENGINEERING
DEPARTMENT OF INFORMATION TECHNOLOGY
IT282.01: INTERNET TECHNOLOGY AND WEB DESIGN
4TH SEMESTER (UNIVERSITY ELECTIVE)

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	02		02	2
Marks	00	100	100	

A. Objective of the Course:

The main objectives for offering the course software project are:

- To describe the basic concepts for web development.
- To provide exposure in the field of Internet Technologies and Web Development.
- Learn the basic working scheme of the Internet and World Wide Web.
- To provide an intuition in web designing and development using Hyper Text Markup Language (HTML).
- Specify design rules in constructing web pages and sites.

B. Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Introduction to WWW	03
2.	Current Trends on Internet	04
3.	HTML Programming Basics	06
4.	Web Publishing and Browsing	09
5.	Services on Internet	04
6.	Electronic Mail	04

Total hours (Theory): 30
Total hours (Lab): 00
Total hours: 30

C. Detailed Syllabus:

1. Introduction to WWW **03 Hours** **10%**

Web Related browser functions, Browser Configuration, Browser Security Issues, Cookies, Spider, Intelligent Agents and special purpose browsers.

2. **Current Trends on Internet** **04 Hours** **13.33%**
Introduction, Languages, Internet Phone, Internet Video, collaborative computing, e-commerce.

3. **HTML Programming Basics** **06 Hours** **20%**
HTML page structure, HTML Text, HTML links, HTML document tables, HTML Frames, HTML Images, multimedia.

4. **Web Publishing and Browsing** **09 Hours** **30%**
Overview, SGML, Web hosting, Documents Interchange Standards, Components of Web Publishing, Document management, Web Page Design Consideration and Principles, Search and Meta Search Engines, Publishing Tools.

5. **Services on Internet** **04 Hours** **13.33%**
E-mail, WWW, Telnet, FTP, IRC and Search Engine.

6. **Electronic Mail** **04 Hours** **13.33%**
Email Networks and Servers, Email protocols –SMTP, POP3, IMAp4, MIME6, Structure of an Email – Email Address, Email Header, Body and Attachments, Email Clients: Netscape mail Clients, Outlook Express, Web based E-mail. Email encryption- Address Book, Signature File.

D. Instructional Method and Pedagogy:

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

<table>
<tr><th>Evaluation</th><th colspan="2">Marks</th><th>Evaluation Methodology</th></tr>
<tr><td>External</td><td colspan="2">70 Marks</td><td>Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.</td></tr>
<tr><td rowspan="2">Internal</td><td>30 Marks</td><td>5 Marks for Attendance</td><td>N/A</td></tr>
<tr><td></td><td>25 Marks for Continuous Evaluation</td><td>Quiz; Assignments, Seminars, Projects, Presentation, etc.</td></tr>
</table>

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

E. Student Learning Outcome:

At the end of the course the students will be able to:

- Review the current topics in Web & Internet technologies.
- Learn the basic working scheme of the Internet and World Wide Web.
- Understand fundamental tools and technologies for web design.
- Comprehend the technologies for Hypertext Mark-up Language (HTML).
- Specify design rules in constructing web pages and sites.

F. Recommended Study Material:

Text Books:

1. HTML 4 , Bryan Pfaffenberge, Bible.
2. Greenlaw R and Hepp E "Fundamentals of Internet and www" 2nd EL, Tata McGrawHill,2007.
3. Comer, "The Internet Book", Pearson Education, 2009

Reference Books:

1. M. L. Young,"The Complete reference to Internet", Tata McGraw Hill, 2007.
2. Godbole AS & Kahate A, "Web Technologies", Tata McGrawHill,2008.
3. Jackson, "Web Technologies", Pearson Education, 2008.
4. Leon and Leon, "Internet for Everyone", Vikas Publishing House.

Web Materials:

1. www.w3schools.com
2. www.tutorialspoint.com

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF TECHNOLOGY & ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING
ME 281.01 ENGINEERING DRAWING
B TECH 3RD SEMESTER (UNIVERSITY ELECTIVE)

Credits Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	00	100	100	

A. Objective of the Course:

- To introduce the student to the universal language and tool of communication of engineers.
- To make them thorough in understanding and using the various concepts of Engineering Drawing.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1	Introduction to Engineering Drawing	05
2.	Visualization of Objects	10
3.	Sectional View of Objects	08
4.	Assembly and Detailed Drawing	04
5.	Introduction to Computer Aided Drawing	03

Total hours (Theory): 30

Total hours (Lab): 00

Total: 30

C. Detailed Syllabus:

1 Introduction to Engineering Drawing 05 Hours 17%

1.1 Basic of engineering graphics.

1.2 Lines, types of lines, use of different line in engineering drawing.

1.3 Dimensioning, placing of dimensions, general rules of dimensions.

2 Visualization of Objects **10 Hours 34%**

2.1 Principle of visualization of objects, need of visualization, methods of visualization of three dimensional objects.

2.2 Interpretation of line and area in orthographic drawing.

2.3 Visualization of objects -pictorial view and orthographic view.

2.4 Visualization of objects- Isometric view.

3 Sectional view of Objects **08 Hours 27%**

3.1 Principle of sectional view of objects,

3.2 Classification of sectional views,

3.3 Full sectional views, half sectional views, convection for sectioning.

4 Assembly and Detailed Drawing **04 Hours 12%**

4.1 Assembly drawing with sectioning from given detailed

4.2 Detail drawing from given assembly

5. Introduction to Computer Aided Drawing **03 Hours 10%**

5.1 Introduction to 2D Drawing facilities in CAD software

5.2 Introduction to 3D modeling & its relationship with 2D drawing views

D. Instructional Methods and Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks		Evaluation Methodology
External	70 Marks		Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

E. Student Learning Outcomes / objectives:

Upon successful completion of this course, the student will be able to:

1. Understand the basics of drawing which is used in industries.
2. To convert sketches to engineered drawings will increase.
3. Improve their visualization skills so that they can apply these skills in developing new products.
4. Know the fundamental of Computer Aided Drawing & 3D Modeling.

F. Recommended Study Material:

Text Books:

1. Shah, P. J., Engineering Drawing Vol. I & II, S. Chand & Co.
2. Bhatt, N. D., Engineering Drawing, Charotar Publishing House

Reference books:

8. Gopal Krishna K.L., Engineering Drawing, Subhas Publications
9. Venugopal, K., Engineering Drawing made Easy, Wiley Eastern Ltd.
10. Agrawal, M.L. & Garg, R.K., Engineering Drawing Vol-I, Dhanpatrai & Co.
11. French, T.E., Vierck, C.J. & Foster, R. J., Graphic Science and Design, McGraw Hill
12. Luzadder, W. J. & Duff, J.M., Fundamentals of Engg. Drawing, Prentice Hall
13. Venugopal, K., Engg. Drawing and Graphics, New Age international Pry. Ltd.

Web Materials:

1. users.rowan.edul-eyerettlcourseslfrcliilLectureslDraw.ppt
2. mechanical-engineering-drawing.ppt.fyxm.net

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF TECHNOLOGY & ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING
ME282.01: MATERIAL SCIENCE
B TECH 4TH SEMESTER (UNIVERSITY ELECTIVE)

Credits Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	00	100	100	

A. Objective of the Course:

- To give an overview on engineering requirements of materials and the importance of structure property relations of engineering materials on their selections and use.
- To understand the testing/ evaluation of strength and other properties of engineering materials.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1	Introduction to Material Science	05
2.	Metals and Alloys	09
3.	Non-Metallic Materials	08
4.	Materials Testing and Inspection	08

Total hours (Theory): 30

Total hours (Lab): 00

Total: 30

C. Detailed Syllabus:

1 Introduction to Material Science 05 Hours 16%

1.1 Classification of engineering materials

1.2 Engineering requirements of materials

1.3 Properties of engineering materials

1.4 Criteria for selection of materials for engineering applications

1.5 Concept of electronic materials, classification, properties and application of electronics materials

2 Metals & Alloys **09 Hours 34%**

2.1 Classification of Metals

2.2 Ferrous Metals: Classification, Composition, Properties, Application (for plain carbon steel, alloy steel including stainless steel and cast iron)

2.3 Non-Ferrous Metals: Classification, Composition, Properties, Application (for copper, copper alloys, aluminum and aluminum alloys)

3 Non-Metallic Materials **08 Hours 25%**

3.1 Introduction and classification of non-metallic materials

3.2 Classification of polymers on basis of thermal behavior (thermoplastics & thermosetting), properties and applications of polymers

3.3 Composites: Introduction, Characteristics of composites, Types and applications of composites

3.4 Other non-metallic materials-types, properties and applications. (like plastic, rubber, ceramics, refectories, insulators, wood etc.)

4. Materials testing and inspection **08 Hours 25%**

4.1 Introduction to Non-destructive testing

4.2 Radiography Testing

4.3 Dye Penetration Testing, Magnetic Particle Testing

4.4 Ultrasonic Testing

4.5 Macro-examination, Spark Test, Macro-etching, Fracture, Microscopic examinations

D. Instructional Methods and Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

<table>
<tr><th>Evaluation</th><th colspan="2">Marks</th><th>Evaluation Methodology</th></tr>
<tr><td>External</td><td colspan="2">70 Marks</td><td>Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.</td></tr>
<tr><td rowspan="2">Internal</td><td>30 Marks</td><td>5 Marks for Attendance</td><td>N/A</td></tr>
<tr><td></td><td>25 Marks for Continuous Evaluation</td><td>Quiz; Assignments, Seminars, Projects, Presentation, etc.</td></tr>
</table>

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case

Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

E. **Student Learning Outcomes:**

Upon successful completion of this course, the student will be able to:

1. Understand basic engineering properties of materials and its Application.
2. Understand fundamentals of various engineering steels and alloys and should have ability to select suitable materials based on their properties.
3. Classify non-metallic materials.
4. Examine various engineering materials.

F **Recommended Study Material:**

Text Books

1. Narang G. B. S. and Manchanedy K., "Materials and Metallurgy", Khanna Pub New Delhi, India
2. Dharmendra K umar and Jain S. K., "Material science and manufacturing process", Vikas Pub House, New Delhi, India
3. R.S.Khurmi and R.S.Sedha, "Material Science", S.Chand
4. D.S.Nutt, "Materials science and metallurgy", S.K.Katariya and sons, Delhi

Reference Book:

1. Raghvan V., "Metallurgy for engineers", Prentice Hall of India
2. Khanna O. P., "Material Science - A Text Book of Material Science & Metallurgy", DhanpatRai Pub

Reading Materials, web materials with full citations:

1. http://ocw.mit.edu/OcwWeb/web/courses/courses/index.htm#MaterialsScienceandEngineering
2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIScBANG/Material%20Science/New_index1.html

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF PHARMACY
University Level Elective for Undergraduate Students of CHARUSAT
SEMESTER III
Fundamentals of Packaging [PH233.01]

Credit and Schemes:

Credits	Teaching Scheme	Evaluation Scheme				
	Contact Hr/Week	Theory		Practical		Total
		Internal	External	Internal	External	
02	02	00	00	30	70	100

A. Course Objectives

The course is structured to introduce the students, with diversified background, to different types of packaging materials generally employed and evaluation methods to be adopted for those packages.

B. Methodology and Pedagogy:

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks		Evaluation Methodology
External	70 Marks		Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

C. Learning Outcome:

Up on completion of the course, students would be able to,

1. Describe and indentify different types of packages
2. Be able to describe significance of tests to be performed to evaluate packages as well to suggest the type of tests to be performed for different type of packages
3. Suggest the type of material likely to be adopted for particular product
4. Describe the steps involved in aseptic manufacturing and packing of products

5. Able to identify different component of aerosol packages and be able to describe role of each of those component

D. Outline of the Course

Sr No.	Unit
1	Introduction to Packaging
2	Packaging of oral solid formulation
3	Sterilization and Sterile Products Packaging including Aerosol Packaging

E. Detailed Syllabus

Sr.No	Units
1	**Introduction to Pharmaceutical Packaging** Definition, introduction to packaging, role of packaging, components of packaging, Overview of the Packaging Development and various aspects of it, Evaluation of packages and Physicochemical characteristics.
2	**Packaging of Oral Solids** Flexible Packaging Materials – Introduction to Plastic, Cellulose and Semi Synthetic Polyemeric Materials, Overview of Packaging of Tablets, Capsules and Powders.
3	**Sterilization and Sterile Products Packaging** Over view of Sterilization Processes, Asepctic Packaging, Packaging Systems, Assessment of Sterility. Aerosol Packaging

F. Recommended Study Material

Core Books

1. Encyclopedia of Pharmaceutical Technology Vol.1-3, Swarbric, J and Bolyln, J. C., Marcel Dekker, Inc., New York.
2. Smart Packaging Technologies for fast moving consumer goods, Editor Joseph Kerry and Paul Butler, Wiley
3. Pharmaceutical Packaging Technology, Dean, D. A. Evans, E. R. and Hall, j. H., Taylor and Francis, London.
4. Handbook of Packaging Technology, by Eiri Board (Engineers India Research Institute).

Reference Books

1. Packaging of Pharmaceutical & Healthcare products, H. Lockhart, F. A. Paine, Champman and Hall, London.
2. Packaging of Pharmaceuticals, C.F. Ross, Newnes-Butterworth.
3. The Theory and Practice of Industrial pharmacy, Lachmann, L., Lieberman, H.A. &Kanig, J.I., Lea and Fibiger, CBS Publishers and Distributers, New Delhi.

Web References

1. http://www.creativebloq.com/branding/packaging-design-resources-4131480
2. https://www.greenerpackage.com/newsletter

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF PHARMACY
University Level Elective for Undergraduate Students of CHARUSAT
SEMESTER IV
Cosmetics in Daily Life [PH238.01]

Credit and Schemes:

Credits	Teaching Scheme	Evaluation Scheme				
	Contact Hr/Week	Theory		Practical		Total
		Internal	External	Internal	External	
02	02	00	00	30	70	100

A. Course Objectives

The course is structured to introduce the students, with diversified background, for preparation and evaluation of commonly used cosmetic formulations. The course will also impart preliminary information about the mechanism through which these products would act.

B. Methodology and Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

<table>
<tr><td>Evaluation</td><td colspan="2">Marks</td><td>Evaluation Methodology</td></tr>
<tr><td>External</td><td colspan="2">70 Marks</td><td>Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.</td></tr>
<tr><td rowspan="2">Internal</td><td>30 Marks</td><td>5 Marks for Attendance</td><td>N/A</td></tr>
<tr><td></td><td>25 Marks for Continuous Evaluation</td><td>Quiz; Assignments, Seminars, Projects, Presentation, etc.</td></tr>
</table>

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

C. Learning Outcome

Up on completion of the course, students would be able to,

1. Describe the current market scenario of cosmetics
2. Describe the various type of cosmetics for skin and hair care
3. Suggest the type of dosage forms likely to be adopted for particular product
4. Describe the evaluation, packaging and labeling of various skin and hair care products.

D. Outline of the Course

Sr. No.	Unit
1	Introduction to Cosmetics and Market Scenario
2	Skin care products
3	Hair care products

E. Detailed Syllabus

Sr. No	Units
1	**Introduction to Cosmetics and Market Scenario** Definition, Classification, Market Scenario in India and World Wide, Introduction to Solution, Suspension, Emulsion etc.
2	**Skin care products** Anatomy and physiology of skin, classification of various skin care products. Formulation, evaluation, packaging and labeling of various skin care products like skin creams and lotions, suntan and anti-sunburn, skin bleaching, skin tonics, anti-aging cream.
3	**Hair care products** Anatomy and physiology of hair, classification of various hair care products. Formulation, evaluation, packaging and labeling of various hair care products like shampoo, conditioner, hair tonics, hair wave sets.

F. Recommended Study Material

Core Books

1. Butler, H. ed., 2013. Poucher's perfumes, cosmetics and soaps. Springer Science & Business Media.
2. Cosmetics Formulation Manufacturing & Quality Control, P.P.Sharma, 4th Ed., Vandana Publications.
3. Handbook of Cosmetic Science and Technology, Andre Barel, Marc Paye, Howard I. Maibach, CRC Press.
4. Cosmetic technology, Nanda S, Nanda A, Khar RK., Birla Publications Pvt. Ltd.
5. Cosmetics: Science and Technology, Balsam S.M. and Sagarin Edward, 2nd Ed, Wiley Interscience.

Reference Books

1. Encyclopedia of Pharmaceutical Technology Vol.1-3, Swarbric, J and Bolyln, J. C., Marcel Dekker, Inc., New York.
2. Draelos, Z.D. ed., 2015. Cosmetic dermatology: products and procedures. John Wiley & Sons.
3. The Theory and Practice of Industrial pharmacy, Lachmann, L., Lieberman, H.A. &Kanig, J.I., Lea and Fibiger, CBS Publishers and Distributers, New Delhi.

Web References

1. www.cir-safety.org/
2. https://www.fda.gov/Cosmetics/
3. https://www.cosmeticseurope.eu/cosmetics
4. www.cdsco.nic.in/

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

University Elective (UG)

PD260.01 BASIC LABORATORY TECHNIQUES

Credit: 02

A. **Objective of the course**

The objectives of this course is to introduce students to the use of various electrical/electronic instruments, their construction, applications, principles of operation, standards and units of measurements; and provide students with opportunities to develop basic skills in the design of electronic equipment.

B. **Outline of the Course**

1. **Error and uncertainty in measurements** (10 Lectures)
   Accuracy and precision, Significant figures, Error and uncertainty analysis, Types of errors: Gross error, systematic error, random error. Statistical analysis of data, (Arithmetic mean, deviation from mean, average deviation, standard deviation, chi-square), and curve fitting, Guassian distribution.

2. **Basic of Measurement** (5 Lectures)
   Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

3. **DC and AC indicating Instruments** (5 Lectures)
   Ideal Constant-voltage and Constant-current Sources, Voltmeter, Ammeters, Cathode Ray Oscilloscope

4. **Signal Generators and Analysis Instruments** (5Lectures)
   Block diagram, explanation and specifications of low frequency signal generators. Pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis.

5. **Digital Instruments** (5Lectures)
   Principle and working of digital meters. Comparison of analog& digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter, working of a digital multimeter.

C. **Instructional Methods and Pedagogy**

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks	Evaluation Methodology
External	70 Marks	Practical Examination, Presentation with Report,

			Case Studies, MOOCs, etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

A. Student Learning Outcomes

Upon successful completion of this course, the student will be able to (Knowledge based) identify electronics/ electrical instruments, their use, peculiar errors associated with the instruments and how to minimise such errors.

B. Recommended Study Material

1. Gupta B. R. (2003). Electronics and Instrumentation.Published by S. Chand and Company Ltd, New Delhi, India.
2. Measurement, Instrumentation and Experiment Design in Physics and Engineering, M. Sayer and A. Mansingh, PHI Learning Pvt. Ltd.
3. Experimental Methods for Engineers, J.P. Holman, McGraw Hill
4. Introduction to Measurements and Instrumentation, A.K. Ghosh, 3rd Edition, PHI Learning Pvt. Ltd.
5. Principles of Electronic Instrumentation, D. Patranabis, PHI Learning Pvt. Ltd.

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF MEDICAL SCIENCES
ManikakaTopawala Institute of Nursing
University Level Elective for Undergraduate students:
NR 251.01- First Aid & Life Support (FALS)

Credits & Scheme:

Semester	Credits	Teaching Scheme	Evaluation Scheme				
		Contact Hours/Week	Theory		Practical		Total
			Internal	External	Internal	External	
III	02	02	00	00	30	70	100

A. Course Objectives

Upon completing the course, students will be able to

- Demonstrate basic first aid skills needed to control bleeding and immobilize injuries.
- Demonstrate the skill needed to assess the ill or injured person.
- Demonstrate skills to assess and manage foreign body airway obstruction in infants, children and adults.
- Demonstrate skills to provide one- and two- person cardiopulmonary resuscitation to infants, children and adults

B. Course Outline

Unit No.	Title of Unit	Prescribed Hours
1.	**Introduction and Basics of First Aid:** • Rescuer Duties, Victim and Rescuer Safety • Looking for Help • After the emergency	2
2.	**Medical emergencies and their first aid**: • Breathing Problems • Choking in an Adult • Allergic Reactions • Heart Attack • Fainting • Diabetes and Low Blood Sugar • Stroke • Shock Abdominal maneuver, CPR, ventilation etc.	12
3.	Injuries emergencies and their first aid: • Bleeding: You Can See/ You Can't See	8

	• Wounds • Burns and Electrical Injuries • Fractures Bandaging, immobilization, transferring etc.	
4.	Environmental Emergencies and first aid: • Bites and Stings • Poison Emergencies • Heat-Related Emergencies • Cold-Related Emergencies	7
5.	Preparation of First Aid Kit	1
	Total	30 Hours

C. **Instruction Method and Pedagogy**

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks		Evaluation Methodology
External	70 Marks		Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

D. **Evaluation:** The students will be evaluated continuously in the form of internal as well as external examinations. The evaluation (Theory) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation in the form of University examination.

Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sr. No.	Component	Number	Marks per incidence	Total Marks
1	Assignments	1	8	8
2	Internal Test/ Model Exam	1	12	12
3	Attendance and Class Participation	Minimum 80% attendance		10
			Total	**30**

External Evaluation

The University Theory examination will be of 70 marks and will test the logic and critical thinking skills of the students by asking them theoretical as well as application based questions. The examination will avoid, as far as possible, grammatical errors and will focus on applications.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Theory Paper	01	70	70
			Total	70

E. **Learning Outcomes:**

At the end of the course, learners will be able to:

- Demonstrate bandaging and immobilization of patient
- Demonstrate the skill for transferring injured person
- Demonstrate skills to clear airway & ventilate the patient
- Demonstrate skills to perform CPR

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF MEDICAL SCIENCES
ManikakaTopawala Institute of Nursing
University Level Elective for Undergraduate students:
NR 261.01- Life Style Diseases & Management (LSDM)

A. Credits & Scheme

Semester	Credits	Teaching Scheme	Evaluation Scheme				
		Contact Hours/Week	Theory		Practical		Total
			Internal	External	Internal	External	
IV	02	02	00	00	30	70	100

B. Course Objectives

Upon completing the course, students will be able to

- Describe the National Health Programmes (NPDCS and NCCP) related to non-communicable diseases
- Understand the risk factors associated with non-communicable diseases and lifestyle disorders
- Understand the concept of health promotion
- Plan, implement, monitor and evaluate a health promotion programme
- Management of life style disorders

C. Course Outline:

Unit No.	Title of Unit	Prescribed Hours
1.	Introduction of NCDs/life-style disorders: • Overview of life-style disorders and epidemiology • Burden of life-style disorders in India and World • Risk factors for life-style disorders	4
2.	Management of Non-communicable diseases: • Obesity • Hypertension • Diabetic mellitus • Cardiovascular diseases • Chronic Kidney Diseases • Cancer • Stroke • Stress • Alcohol and drug abuse	20

3.	Preventive aspects of life-style diseases • Health Promotion strategies • Physical activity • Role of diet	4
4.	National Health Programmes (NPDCS and NCCP) related to non-communicable diseases	2
	Total	30 Hours

D. Instruction Method and Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks		Evaluation Methodology
External	70 Marks		Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

E. Evaluation

The students will be evaluated continuously in the form of internal as well as external examinations. The evaluation (Theory) is schemed as 30 marks for internal evaluation and 70 marks for external evaluation in the form of University examination.

Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Assignments	1	8	8
2	Internal Test/ Model Exam	1	12	12
3	Attendance and Class Participation	Minimum 80% attendance		10
			Total	**30**

External Evaluation

The University Theory examination will be of 70 marks and will test the logic and critical thinking skills of the students by asking them theoretical as well as application based questions. The examination will avoid, as far as possible, grammatical errors and will focus on applications.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Theory Paper	01	70	70
			Total	70

F. Learning Outcomes

At the end of the course, learners will be able to:

- Describe the National Health Programmes (NPDCS and NCCP) related to non-communicable diseases
- Understand the risk factors associated with non-communicable diseases and lifestyle disorders
- Understand the concept of health promotion
- Plan, implement, monitor and evaluate a health promotion programme
- Management of life style disorders

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF MEDICAL SCIENCES
ASHOK & RITA PATEL INSTITUTE OF PHYSIOTHERAPY
Semester III (University Elective)
PT191.01 HEALTH PROMOTION&FITNESS

Credit Hours

Hrs. / Wk.			Credits			Total Marks		Total
L	P	T	L	P	T	Theory	Practical	
02			02			00	100	100

A. **Objectives of The Course**

This course will introduce students to the basic concept of health promotion, fitness and screening and basic assessment of fitness.

B. **Outline of The Course**

Sr. No.	Title of the unit	Minimum number of hours
1.	Basic Concept of Health Promotion	12
2.	Epidemiology and Health Promotion in Different Setting	12
3.	Basic Concept of Fitness	12
4.	Fitness Assessment	12

Total hours (Theory) : 48
Total hours (Practical): 00
Total hours: 48

C. Detailed Syllabus

1 **Basic Concept of Health Promotion** **12hrs**
1.1 Meaning of health and Wellness
1.2 Cultural &Social determinants of Health
1.3 Physical, Environmental, Emotional & Psychological health

1.4 Promotion of Healthy Lifestyles through Physical Activity, Diet, Stress Management, Avoiding Tobacco – Alcohol

1.5 Promotion of Personal Hygiene, Treatment Seeking Behavior, Treatment Compliance and Reducing Stigma

1.6 Need of health promotion in India

2 Epidemiology and Health Promotion in Different Setting 12hrs

2.1 Health Statistics: Analysis and Interpretation of Data Related to Health Promotion

2.2 Use of Health Management Information System and Information Technologies in

2.3 Health Promotion

2.4 Health promotion in different settings - emergency and disaster

Different areas of health promotion in India as compared to developed countries

3 Basic Concept of Fitness 12 Hrs

3.1 Introduction definition of term :Fitness

3.2 Basic Concepts Of Fitness

3.3 Mental and physical fitness

3.4 Health benefits of activity and Fitness

4 **Fitness Assessment 12Hrs**

4.1 Multifactorial fitness assessment and screening : Physical activity screening :Identify risk factors, height, weight, BMI, Physically active hours

4.2 Aerobic fitness, Muscular Fitness, Activity and Weight control

Vitality and Longevity

4.3 Clinical preventive screening for infants

4.4 Nutritional screening

D. Instructional Method and Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks	Evaluation Methodology
External	70 Marks	Practical Examination, Presentation with Report, Case Studies, MOOCs,

			etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

E. Student Learning Outcomes

At the end of the semester the student will be able:

1. To review the basics health, Promotion& Fitness
2. To understand the need of Health Promotion
3. To understand basic concept of fitness
4. To develop necessary skill to screen and assess basics of fitness

F. Recommended Study Material

Text Books

1. Textbook of Preventive & Social Medicine- Dr. K. Park
2. Textbook of community medicine: V. K. Mahajan
3. Chiropractic, Health,Promotion and Wellness –MeridelI.Gatterman MA, DC,Med
4. Health ,Promotion and Wellness :evidence based guide to clinical preventive services—Cheryl Hawk & Will Evas
5. Fitness and Health – 6th edition – Brian J Sharkey,PhD

Reference Books

1. Principles Of Health Education And Health Promotion, (2nd edition), J. Thomas Butler, Morton Publishing Company, Englewood, Colorado
2. Foundations Of Health Education, R. M. Eberst, Editor, Coyote Press, San Bernardino: 1998-99
3. Evaluation in health promotion – principles and perspective- WHO Regional Publications, European Series, No. 92
4. Principles and foundation of health promotion and education(5th edition) by Randall R. Cottrell, James T. Girvan, James F. McKenzie

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF MEDICAL SCIENCES
ASHOK & RITA PATEL INSTITUTE OF PHYSIOTHERAPY
Semester IV (University Elective)
PT192.01 OCCUPATIONAL HEALTH & ERGONOMICS

Credit Hours:

Hrs. / Wk.			Credits			Total Marks		Total
L	P	T	L	P	T	Theory	Practical	
02			02			00	100	100

A. **Objectives of The Course**

This course will introduce students to the basic concept of occupational health & Ergonomics Assessment and management for prevent the Occupational Hazards.

B. **Outline of The Course**

Sr. No.	Title of the unit	Minimum number of hours
1.	Occupational Health	06
2.	Ergonomics	12
3.	Environmental Factors & Ergonomics	06
4.	Occupational Ergonomics	12
5.	Occupational Ergonomics In Special Areas	12

Total hours (Theory) : 48
Total hours (Practical): 00
Total hours: 48

C. **Detailed Syllabus**

1 **Occupational Health** **06hrs**

1.1 Introduction.

1.2 Objective & basic concepts of Occupational health.

1.3 Reorganization of health hazards.

1.4 Early detection of Occupational diseases.

2 Ergonomics 12hrs

2.1 Definitions of terms: Ergonomics, Ergonomists. Social significance of ergonomics.

2.2 Biomechanical, Physiological & Anthropometric factors related to ergonomics.

2.3 Ergonomical aspects of Postures like Sitting, Standing, Hand & arm postures.

2.4 Ergonomical aspects of movements like Pushing, Pulling, Lifting & carrying.

3 Environmental Factors & Ergonomics 06 hrs

3.1 Noise, Light, Vibration, Climate & Chemical substances.

4 Occupational Ergonomics 12 hrs

4.1 Work environment and control measures in work place.

4.2 Prevention of occupational diseases and accidents.

4.3 Effects of lifestyle and behavior on health.

4.4 Health education in the workplace.

5 Occupational Ergonomics In Special Areas 12 hrs

5.1 Industrial worker.

5.2 Agriculture and rural areas.

5.3 Working women.

5.4 IT – BPO industries.

D. Instructional Method And Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks		Evaluation Methodology
External	70 Marks		Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

E. Student Learning Outcomes

At the end of the semester the student will be able:

- To review the basics of Occupational health & Ergonomics
- To understand the problem associated with workplace.
- To clinically correlate the Occupational hazards and Ergonomics.

F. Recommended Study Material

Text Books

1. Benjamin O. ALLI, Fundamental Principles of Occupational Health and Safety, Second edition, ILOInternational Labour Organization 2008
2. M. Rabiul&Ahasan: Occupational Health, Safety and Ergonomic issues in small and medium- sized Enterprises in a Developing Country. OULU 2002
3. WaldemarKarwowski& William S. Marras: Occupational Ergonomics – Design and management of Work System; CRC Press, Boca Raton, FL, 1999
4. Occupational Health : A manual for primary health care workers; WHO-EM/OCH/85/E/L

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

FACULTY OF COMPUTER APPLICATION

CA 224 Introduction to Web Designing

Credits and Hours:

<table>
<tr><th>Teaching Scheme</th><th>Theory</th><th>Practical</th><th>Total</th><th>Credit</th></tr>
<tr><td>Hours/week</td><td colspan="2">2</td><td>2</td><td rowspan="2">2</td></tr>
<tr><td>Marks</td><td>00</td><td>100</td><td>100</td></tr>
</table>

A. Objective

The objective of the course is to provide basic understanding of designing professional web page templates with Markup Language Tags.

B. Methodology & Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

<table>
<tr><th>Evaluation</th><th colspan="2">Marks</th><th>Evaluation Methodology</th></tr>
<tr><td>External</td><td colspan="2">70 Marks</td><td>Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.</td></tr>
<tr><td rowspan="2">Internal</td><td>30 Marks</td><td>5 Marks for Attendance</td><td>N/A</td></tr>
<tr><td></td><td>25 Marks for Continuous Evaluation</td><td>Quiz; Assignments, Seminars, Projects, Presentation, etc.</td></tr>
</table>

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

C. Learning Outcome:

Upon successful completion of the course, students will understand basic concepts of internet and web page designing and design and develop entire web sites using several web designing editors and HTML scripting language.

D. Outline of the Course

Sr. No.	Content
1	Overview of Internet and WWW, Basic elements of the Internet, Internet services, Internet Browsers and Servers, Hardware and Software requirements to connect to the internet, Internet Service Provider (ISP), Introduction to Internet Protocols
2	Introduction to Web Page, Web Site, Web Browser, Overview of HTML, Structure of HTML Documents, HTML comments
3	HTML Basics Tags :Paragraph Tags, Horizontal Rule Tag, Heading Tags, Block quote Tags, Address Tags, PRE Tag,
4	Other HTML tags:- Formatting tags , Marquee tag, DIV tag, and SPAN tag
5	HTML List & Hyperlink in HTML (text link, image link, email link and many more)
6	HTML Images:- <img> tag and <map> tag
7	HTML Table
8	HTML Form
9	HTML Frames

Total Hours (Practical): 24

E. Recommended Study Material

Core Books

1. Harley Hahn: The Internet Complete Reference, 2 nd Edition, Tata McGraw-HILL Edition.
2. Thomas a Powell: The Complete reference HTML, 3rd Edition, McGraw Hill, 2001.
3. A. Whyte: Basic HTML, 2nd Edition, Payne-Gallway, Oxford, 2003.
4. Farrar: HTML Example book, BPB, 2007.

Reference Books

1. Ivan Bayross: Web Enabled Commercial Application Development using HTML, JavaScript, DHTML and PHP, 4th revised edition, BPB Publication.
2. Jeremy Keith : HTML5 for Web Designers, A Book Apart Jeffrey Zeldmann, 2010
3. Peter Morville & Louis Rosenfeld, Information Architecture for WWW, 3rd Edition, O'Reilly Publication, 2006.

Web References

1. http://www.w3schools.com/html/[HTML notes]
2. http://www.tutorialspoint.com/html/ [HTML Materials]
3. http://www.tutorialspoint.com/html5/[HTML5 notes]

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

FACULTY OF COMPUTER APPLICATION

CA 225 Programming the Internet

Credits and Hours

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	00	100	100	

A. Objective

The objective of this course is to provide working knowledge of design effective and attractive web pages using HTML5 and CSS.

Pre-requisite: Basic knowledge of HTML

B. Methodology & Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks		Evaluation Methodology
External	70 Marks		Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

C. Learning Outcome

Upon Successful completion of the course, Students will learn the concepts of CSS from basic to advance. Students will be able to design attractive web pages using HTML5 and CSS

D. Outline of the Course

Sr. No.	Content
1	HTML5: Introduction, New Elements, Semantics, Media: Audio and Video
2	Forms: Input Types, Form Elements, Form Attributes, Graphics: Canvas
3	Introduction to Cascading Style Sheet (CSS), CSS layout, CSS essentials,
4	CSS selectors, CSS Box Model and Wrapper class
5	CSS Backgrounds and CSS Borders
6	CSS Text and Fonts and CSS List
7	CSS Tables, CSS Display, CSS Navigation and CSS Button
8	CSS Image Gallery and CSS 3:- Transforms, Transitions, Animation

Total Hours (Practical): 24

F. Recommended Study Material

Core Books

1. Matthew MacDonald: HTML5: The Missing Manual, O'Reilly Media, August 2011.
2. Peter Gasston: The Book of CSS3: A Developer's Guide to the Future of Web Design, No Starch Press, April 2011.
3. Richard York: Beginning CSS: Cascading Style sheets for Web Design, Wrox Press (Wiley Publishing), 2014.

Reference Books

1. Ivan Bayross: Web Enabled Commercial Application Development using HTML, JavaScript, DHTML and PHP, 4th revised edition, BPB Publication.
2. David Mc Farland: CSS: The Missing Manual, O'Reilly, 2006.
3. Thomas Powell: HTML & CSS: The Complete Reference, Fifth Edition Paperback, 2010

Web References

1. http://www.w3schools.com/html/html5_intro.asp[HTML5 notes]
2. http://www.w3schools.com/css/[CSS notes]
3. http://www.tutorialspoint.com/internet_technologies/html.htm [HTML notes]
4. http://james-star.com/answers/en/css3-hover-effect-transitions-transformations-and-animations/[Animation in CSS]

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

FACULTY OF MANAGEMENT STUDIES

BM231: BANKING AND INSURANCE (B & I)

(Choice Based Credit System – University Elective)

YEAR 2, SEMESTER 3

A. **Number of Credits : 2**

B. **Course Objectives**

The objectives of this course are:

- To equip the students with the knowledge of basic banking operation and Insurance industry.
- To recognize opportunities brought about by the dramatic changes that have occurred in the past decade in the banking and insurance industry.

C. **Course Outline**

Module No.	Title/Topic	Classroom Contact Sessions
1	**Evolution of Banking** • *Brief Structure of Banks* • *Systems of Banking-Mixed,Branch,Unit,Group, Chain* • *RBI-Organization & Functions* • *Methods of Credit Control& Credit Creation.* • *Commercial Banking* • *Universal Banking*	5
2	**Bank Management** • *Sources and Uses of Funds in Banks* • *Balance sheet of a Bank* • *Value Chain Analysis in Banking Industry* • *Emergingtrends in Banking* • *Credit Cards* • *E-Banking*	5
3	**Retail Banking – An Introduction** • *Open Market Conditions and Role of Banks and Financial Institutions* • *Retail Banking –Concept and Importance.* • *Retail Banking Products- Housing Loan, Conveyance Loan, Personal Loan, Educational Loan, Loan for Retail Traders* • *Plastic Money*	5
4	**Marketing of Banking Services – Banking Products and Services** • *Distribution, Pricing and Promotion Strategy for Banking Services* • *Attracting and Retaining Bank Customers* • *Marketing Strategy of Credit Cards, Debit Cards, Saving Accounts and Different*	5

Module No.	Title/Topic	Classroom Contact Sessions
	Types of Loans	
5	**Introduction to Insurance Sector** • *Concept of Risk: Types of Risk, Risk Appraisal, Transfer and Pooling of Risks, Concept of Insurable Risk.* • *Concept of Insurance: Relevance of Insurance* • *Types of Insurance Organisations* • *Intermediaries in Insurance Business* • *Formation of Insurance Contract: Life, Fire, Marine and Motor Insurance Contracts* • *Principles of Insurance: Utmost Good Faith, Indemnity, Insurable Interest.*	5
6	**Practice of Life Insurance** • *Insurance Products, a Hedge Against Personal Risk (s)* • *Insurance Products, Alternative to Investment Products* • *Insurance Products, Collateral Security in the Rising Hire-Purchase Market Scenario* • *Marketing of Insurance Products- Life and Non Life Products* • *I.T in Insurance Business: Internet Based Delivery of Insurance Products, Servicing of Policies*	5
	Total	**30**

D. Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

Evaluation	Marks		Evaluation Methodology
External	70 Marks		Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.
Internal	30 Marks	5 Marks for Attendance	N/A
		25 Marks for Continuous Evaluation	Quiz; Assignments, Seminars, Projects, Presentation, etc.

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

E. Learning Outcomes

At the end of the course, the student should have learnt

- Knowledge about various functions associated with banking.
- Practice and procedures relating to deposit and credit, documentation, monitoring and control.
- An insight into banking services and banking technology.
- Understanding about the insurance sector and its products.

G. Recommended Study Material

Text-Book

1. BhartiPathak, Indian Financial System, Pearson Education, Latest Edition
2. Gupta, P K. , Fundamentals of Insurance, Himalaya Publishing House, Latest Edition

Reference-Books

1. Latest Publications of Insurance Regulatory Authority of India
2. Khan M A, Introduction to Insurance, Educational Publication House, Aligarh, Latest Edition

Journals / Magazines / Newspapers

1. Journal on Banking Financial Services and Insurance Research
2. The Indian Banker

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

FACULTY OF MANAGEMENT STUDIES

BM241: HEALTHCARE MANAGEMENT (HCM)

(Choice Based Credit System – University Elective)

YEAR 2, SEMESTER 4

A. **Number of Credits : 2**

B. **Course Objectives**

The objectives of this course are:

- To help students understand, gain knowledge, and develop an appreciation of health care management by exploring all aspects of the field.
- To provide a foundation of applying managerial knowledge within health care sector.

C. **Course Outline**

Module No.	Title/Topic	Classroom Contact Sessions
1	**Hospital Planning and Medical Care** • Steps Involved in Hospital Planning • Managing Patient Care Service • Managing Support Services • Administration and Engineering Service	5
2	**Health Sector Financing and Reforms** • Health Care Financing in India and Developed Nations • National Health Spending • Health Sector Reforms • Resource Generation for Hospitals • Hospital Financing Alternatives	5
3	**Role of Private Sector in Health Care** • Private Health Sector • Expanding the Private Sector Health Care Financing • Public- Private Mix in Health Care Sector • Legal Issues in Health Care Sector	5
4	**Health Care Economics and Finance and Marketing** • Economic Appraisal of Health Services • Needs Vs Demand Vs Supply Model • Health Service Financing and Expenditure Survey, Budgeting, Control, Pricing, and Efficiency • Production and Cost of Health Care • Hospital Costs and Efficiency Marketing Health and Family Welfare • Social Marketing for Health and Family Welfare	5

<table>
<tr><th>Module No.</th><th>Title/Topic</th><th>Classroom Contact Sessions</th></tr>
<tr><td></td><td>Marketing for Hospitals
Health Services Marketing; Pharmaceutical Marketing
Patient as a Customer</td><td></td></tr>
<tr><td>5</td><td>Legal Aspects of Healthcare Management
Mitigate Liability Through Risk Management Principles
Develop Relationship Management Skills
Apply an Ethical Decision-Making Framework
Incorporate Employment Law Procedures
Manage Communication</td><td>5</td></tr>
<tr><td>6</td><td>Health Care and Social Pol icy
Social Welfare
Approaches to Analysis
Distribution of Health Services in India</td><td>5</td></tr>
<tr><td></td><td>Total</td><td>30</td></tr>
</table>

D. Pedagogy

- University Elective Course shall be of 100 Marks. The Suggested evaluation component are as below;

<table>
<tr><th>Evaluation</th><th colspan="2">Marks</th><th>Evaluation Methodology</th></tr>
<tr><td>External</td><td colspan="2">70 Marks</td><td>Practical Examination, Presentation with Report, Case Studies, MOOCs, etc.</td></tr>
<tr><td rowspan="2">Internal</td><td>30 Marks</td><td>5 Marks for Attendance</td><td>N/A</td></tr>
<tr><td></td><td>25 Marks for Continuous Evaluation</td><td>Quiz; Assignments, Seminars, Projects, Presentation, etc.</td></tr>
</table>

- The Pedagogy for application mode may include laboratory Sessions, Presentation, Case Studies and Discussions, MOOCs under staff observation or any adequate methodology which may befit the course structure.

E. Learning Outcomes

At the end of the course, the student should have learnt:

- The relationship of social need for health care services and contemporary issues prevailing to it.

H. Recommended Study Material

Text-Book

1. S.L.Goel, Health Care Policies and Programmes, Deep and Deep Publications Pvt Ltd, Latest Edition

Reference-Books

1. G.D. Kunders, Designing for Total Quality in Health Care, Prism Books Pvt. Ltd., Bangalore, Latest Edition
2. B.M. Sakharkar, Principles of Hospital Administration and Planning, Jaypee Brothers Medical Publishers Pvt. Ltd., Latest Edition

Journals / Magazines / Newspapers

1. International Journal of Health Planning and Management
2. Health Policy and Planning Journal

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF APPLIED SCIENCES
DEPARTMENT OF PHYSICAL SCIENCE

PD261 : Astrophysics, Space and Cosmos-1 (ASC–1)

University Elective
Semester 3 Undergraduate Programme

Prerequisite:

Student having exposure of 10+2 level of Physics, and studying in bachelor and master program from any institute can join this course.

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	-	2	2	2
Marks	-	100	100	

A. Objective of the Course:

There have been frontier developments in recent months and past couple of years which involve major coming together of cosmology, physics and engineering sciences, such as the gravitational waves detected by LIGO and the fascinating images of shadows of the ultra-compact objects (e.g. black hole) at the center of our neighboring galaxy M87. This development have spurred major interest in young students, citizens as well as scientific community as a whole and major research activities have started throughout the world & internationally in the academic centers. There is a huge interest in CHARUSAT students also. To meet up this demand & to create frontier research activity in terms of projects and proposals this course Astrophysics, Space and Cosmos has been devised. These will create important dividends in terms of frontier research emerging from CHARUSAT.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1.	Basic Astronomical Techniques	10
2.	The Frontier of Space	06
3.	The Life and Death of Stars	08
4.	The Universe	06

Total Hours (Theory): 0 Total Hours (Lab): 30 Total Hours: 30

C. Detailed Syllabus:

1.	**Basic Astronomical Techniques**	**10 Hrs**
	Description of Telescopes, Methods of observation, electromagnetic spectral window, resolution, sensitivity, noise, signal to noise ratio, background, aberrations, Telescopes at different wavelengths, Detectors at different wavelengths, Imaging techniques, spectroscopy, calibration, Atmospheric effects at different wavelengths, Astronomical data analysis, H-R diagram, sun and solar system, Sky Gazing.	6 (L) + 4 (P)
2.	**The Frontier of Space**	**6 Hrs**
	Outer reaches of earth's Atmosphere, Earth's Atmospheric Layers and Orbital Mechanism: Types of Orbits Launching of Satellites, Basics of Satellite subsystems, channel and link. Satellite Applications: Earth Observation, Scientific Study, Weather Forecast, Military Applications, GPS.	
3.	**The Life and Death of Stars**	**8 Hrs**
	Stars and Galaxies, The story of collapsing stars: Star formation and evolution, Interstellar Nebula, Red Giant, Planetary Nebulae, Planetary Dynamics, White Dwarfs, Red super Giant, Supernovae- Neutron star, Black hole, naked singularity. Gravitational Lensing, Accretion disks Around Compact Objects, Binary pulsar, Gravitational Waves.	
4.	**The Universe**	**6 Hrs**
	Universe in different scale: solar scale, Galactic scale, Cosmological scale, vastness of our universe, Expanding universe (Big bang, inflation), some interesting facts of our universe.	

D. Instructional Methods and Pedagogy

The topics will be discussed in interactive class room sessions using classical black-board teaching, ICT, hands-on-experiments and demonstration of experiments, whichever is relevant. Assignments, small projects and lab-exercise will be to the students. Student's needs to submit solution/report/results of above mentioned work, which will be eventually used for the evaluation purpose. Occasionally seminar/viva presentation will also be used as one of the evaluation tools.

E. Student Learning Outcomes:

Students will get preliminary knowledge about Astrophysics, Space and Cosmology. This is a level one course, which provides basis for the second level course. After completion of this course, students can start taking small project in this or allied fields.

F. Recommended Study Materials

❖ **Reference Book & Text Book:**

1. The Story of Collapsing Stars: Black Holes, Naked Singularities, and the Cosmic Play of Quantum Gravity, Prof. Pankaj S. Joshi
2. An Introduction to Cosmology 3ed, J.V. Narlikar
3. An introduction to modern cosmology, Andrew R. Liddle
4. Astronomy: Astronomy for Beginners: The Magical Science of Stars, Galaxies, Planets, Black Holes, Wormholes and much, much more! (Astronomy, Astronomy Textbook, Astronomy for Beginners), Miles Clarke
5. Satellite Communication, Dennis Roddy, Mc-Graw Hill publication
6. Satellite Communication, Timothy Pratt, Charles Bostian, Jeremy Allnut, John Wiley and Sons publication

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY FACULTY OF APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCE

PD262 : Astrophysics, Space and Cosmos-2 (ASC- 2)

University Elective
Semester 4 Undergraduate Programme

Prerequisite:

Student having exposure of 10+2 level of Physics, and studying in bachelor and master program from any institute can join this course.

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	-	2	2	2
Marks	-	100	100	

A. Objective of the Course:

There have been frontier developments in recent months and past couple of years which involve major coming together of cosmology, physics and engineering sciences, such as the gravitational waves detected by LIGO and the fascinating images of shadows of the ultra-compact objects (e.g. black hole) at the center of our neighbouring galaxy M87. This development have spurred major interest in young students, citizens as well as scientific community as a whole and major research activities have started throughout the world & internationally in the academic centres. There is a huge interest in CHARUSAT students also. To meet up this demand & to create frontier research activity in terms of projects and proposals this course Astrophysics, Space and Cosmos has been devised. These will create important dividends in terms of frontier research emerging from CHARUSAT.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1.	Black holes and Shadows	10
2.	Gravitational Waves	06
3.	Sensors and Detectors for Satellite Imaging	08
4.	Cosmology	06

Total Hours (Theory): 0

Total Hours (Lab): 30

Total Hours: 30

C. Detailed Syllabus:

1.	**Black holes and Shadows**	**10 Hrs**
	Spacetime, Schwarzschild metric, Null Geodesics in Schwarzschild metric, Photon sphere, Einstein ring, Shadow of Black hole, shadow of Naked singularity, recent observation of black hole image (M87 Galaxy), experiments using imaging technique	8 (L) + 2 (P)
2.	**Gravitational Waves**	**6 Hrs**
	Introduction to Gravitational Waves; recent development for the detection of Gravitational waves; Overview of Gravitational Wave detectors (i.e. LIGO, KAGRA, etc.) and its scientific and technologic importance; Outline of Interferometers & its applications; Construction and working of Michelson Interferometer & its application potentiality in Advance- LIGO; Demonstration experiment of Michelson Interferometer.	4 (L) + 2 (P)
3.	**Sensors and Detectors for Satellite Imaging**	**8 Hrs**
	Introduction to sensors, Signal, Parameters, Types of Sensors: CCD and CMOS, CMOS sensors: Architecture Configuration and Working, CCD sensors: Architecture Configuration and Working.	
4.	**Cosmology**	**6 Hrs**
	Galaxies: General Description, The Milky-Way, M87 Galaxy, Rotation Curves of Spiral Galaxies, Galaxy Formation, Expanding Universe, Hubble's Law, Dark matter and Dark Energy.	

D. Instructional Methods and Pedagogy:

The topics will be discussed in interactive class room sessions using classical black-board teaching, ICT, hands-on-experiments and demonstration of experiments, whichever is relevant. Assignments, small projects and lab-exercise will be to the students. Students needs to submit solution/report/results of above mentioned work, which will be eventually used for the evaluation purpose. Occasionally seminar/viva presentation will also be used as one of the evaluation tools.

E. Student Learning Outcomes:

After completion of Astrophysics, Space and Cosmology level one and two courses, students will explore themselves for taking projects, which may eventually fulfill their curiosity in these and allied fields. It may open up new avenues in their career.

F. Recommended Study Materials

❖ **Reference Book & Text Book:**

1. The Story of Collapsing Stars: Black Holes, Naked Singularities, and the Cosmic Play of Quantum Gravity, Prof. Pankaj S. Joshi
2. An Introduction to Cosmology 3ed, J.V. Narlikar
3. An introduction to modern cosmology, Andrew R. Liddle
4. Astronomy: Astronomy for Beginners: The Magical Science of Stars, Galaxies, Planets, Black Holes, Wormholes and much, much more! (Astronomy, Astronomy Textbook, Astronomy for Beginners), Miles Clarke
5. Satellite Communication, Dennis Roddy, Mc-Graw Hill publication
6. Satellite Communication, Timothy Pratt, Charles Bostian, Jeremy Allnut, John Wiley and Sons publication.
7. CMOS/CCD Sensors and Camera Systems, Second Edition, Gerald Holst, Terrence S Lomheim, SPIE publication.
8. Review article: Advanced LIGO, The LIGO Scientific Collaboration, Classical and Quantum Gravity, Volume 32, Number 7 (2015)

ACADEMIC REGULATIONS & SYLLABUS

(Choice Based Credit System)

Faculty of Technology & Engineering

Bachelor of Technology Programme
(Third Year Mechanical Engineering)

Education Campus – Changa, (ECC), hitherto a conglomerate of institutes of professional education in Engineering, Pharmacy, Computer Applications, Management, Applied Sciences, Physiotherapy and Nursing, is one of the choicest destinations by students. It has been transformed into Charotar University of Science and Technology (CHARUSAT) through an Act by Government of Gujarat. CHARUSAT is permitted to grant degrees under Section-22 of UGC- Govt. of India.

The journey of CHARUSAT started in the year 2000, with only 240 Students, 4 Programmes, one Institute and an investment of about Rs. 3 Crores (INR 30 million). At present there are seven different institutes falling under ambit of six different faculties. The programmes offered by these faculties range from undergraduate (UG) to Ph.D degrees including M.Phil. These faculties, in all offer 23 different programmes. A quick glimpse in as under:

Faculty	Institute	Programmes Offered
Faculty of Technology & Engineering	Chandubhai S. Patel Institute of Technology	B. Tech M. Tech Ph. D
	Devang Patel Institute of Advance Technology and Research	B.Tech CE CSE IT
Faculty of Pharmacy	Ramanbhai Patel College of Pharmacy	B. Pharm M. Pharm Ph. D PGDCT/ PGDPT
Faculty of Management Studies	Indukaka Ipcowala Institute of Management	M.B.A PGDM Ph.D Dual Degree BBA+MBA
Faculty of Applied Sciences	P.D.Patel Institute of Applied Sciences	M.Sc M.Phil Ph.D Dual Degree B.Sc+M.Sc
Faculty of Computer	Smt. Chandaben Mohanbhai Patel Institute of	M.C.A/MCA

Faculty	Institute	Programmes Offered
Applications	Computer Applications	(Lateral) M.Sc IT Ph. D Dual Degree BCA+MCA
Faculty of Medical Sciences	Ashok and Rita Institute of Physiotherapy	B.PT M.PT Ph.D
	Manikaka Topawala Institute of Nursing	B.Sc M.Sc GNM
	Charotar Institute of Paramedical Sciences	Ph.D PGDHA

The development and growth of the institutes have already led to an investment of over Rs.63 Crores (INR 630 Million). The future outlay is planned with an estimate of Rs. 250 Crores (INR 2500 Million).

The University is characterized by state-of-the-art infrastructural facilities, innovative teaching methods and highly learned faculty members. The University Campus sprawls over 100 acres of land and is Wi-Fi enabled. It is also recognized as the Greenest Campus of Gujarat.

CHARUSAT is privileged to have 350 core faculty members, educated and trained in Stanford, IITs, IIMs and leading Indian Universities, and with long exposure to industry. It is also proud of its past students who are employed in prestigious national and multinational corporations.

From one college to the level of a forward-looking University, CHARUSAT has the vision of entering the club of premier Universities initially in the country and then globally. High Moral Values like Honesty, Integrity and Transparency which has been the foundation of ECC continues to anchor the functioning of CHARUSAT. Banking on the world class infrastructure and highly qualified and competent faculty, the University is expected to be catapulted into top 20 Universities in the coming five years. In order to align with the global requirements, the University has collaborated with internationally reputed organizations like Pennsylvania State University – USA, University at Alabama at Birmingham – USA, Northwick Park Institute –UK, ISRO, BARC, etc.

- ☞ Participatory and interactive discussion-based classes.
- ☞ Sessions by visiting faculty members drawn from leading academic institutions and industry.
- ☞ Regular weekly seminars.
- ☞ Distinguished lecture series.
- ☞ Practical, field-based projects and assignments.
- ☞ Summer training in leading organizations under faculty supervision in relevant programmes.
- ☞ Industrial tours and visits.
- ☞ Extensive use of technology for learning.
- ☞ Final Placement through campus interviews.

Exploration in the field of knowledge through research and development and comprehensive industrial linkages will be a hallmark of the University, which will mould the students for global assignments through technology-based knowledge and critical skills.

The evaluation of the student is based on grading system. A student has to pursue his/her programme with diligence for scoring a good Cumulative Grade Point Average (CGPA) and for succeeding in the chosen profession and life.

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

Faculty of Technology and Engineering

ACADEMIC REGULATIONS

Bachelor of Technology (Mechanical Engineering) Programme

(Choice Based Credit System)

Charotar University of Science and Technology (CHARUSAT)
CHARUSAT Campus, At Post: Changa – 388421, Taluka: Petlad, District: Anand
Phone: 02697-247500, Fax: 02697-247100, Email: info@charusat.ac.in
www.charusat.ac.in

Year 2018-19

CHARUSAT

FACULTY OF TECHNOLOGY AND ENGINEERING
ACADEMIC REGULATIONS
Bachelor of Technology Programmes
Choice Based Credit System

To ensure uniform system of education, duration of undergraduate and post graduate programmes, eligibility criteria for and mode of admission, credit load requirement and its distribution between course and system of examination and other related aspects, following academic rules and regulations are recommended.

1. *System of Education*

Choice based Credit System with Semester pattern of education shall be followed across The Charotar University of Science and Technology (CHARUSAT) both at Undergraduate and Master's levels. Each semester will be at least 90 working day duration. Every enrolled student will be required to take a course works in the chosen subject of specialization and also complete a project/dissertation if any. Apart from the Programme Core courses, provision for choosing University level electives and Programme/Institutional level electives are available under the Choice based credit system.

2. *Duration of Programme*

(i)	Undergraduate programme	(B.Tech)
	Minimum	8 semesters (4 academic years)
	Maximum	16 semesters (8 academic years)

3. *Eligibility for admissions*

As enacted by Govt. of Gujarat from time to time.

4. *Mode of admissions*

As enacted by Govt. of Gujarat from time to time.

5. *Programme structure and Credits*

As per annexure – 1 attached

6. Attendance

6.1 All activities prescribed under these regulations and listed by the course faculty members in their respective course outlines are compulsory for all students pursuing the courses. No exemption will be given to any student from attendance except on account of serious personal illness or accident or family calamity that may genuinely prevent a student from attending a particular session or a few sessions. However, such unexpected absence from classes and other activities will be required to be condoned by the Dean/Principal.

6.2 Student attendance in a course should be 80%.

7 Course Evaluation

7.1 The performance of every student in each course will be evaluated as follows:

7.1.1 Internal evaluation by the course faculty member(s) based on continuous assessment. The continuous assessment will be conducted by the respective department/ institute.

7.1.2 Final end-semester examination by the University through written paper or practical test or oral test or presentation by the student or combination of these.

7.1.3 The weightages of continuous assessment and end-semester University examination in overall assessment shall depend on individual course as approved by Academic Council through Board of Studies.

7.1.4 The performance of candidate in continuous assessment and end-semester examination together (if applicable) shall be considered for deciding the final grade in a course.

7.1.5 In order to earn the credit in a course a student has to obtain grade other than FF.

7.2 Performance in continuous assessment and end-semester University Examinations

7.2.1 Minimum performance with respect to continuous assessment as well as end-semester university examination will be an important consideration for passing a course. Details of minimum percentage of marks to be obtained in the examinations are as follows:

Minimum percentage marks to be obtained in end-semester University examination (for applicable courses)	Minimum overall percentage marks to be obtained in each course
40%	45%

7.2.2 If a candidate obtains minimum required percentage of marks in end-semester University examination in an applicable course but fails to obtain minimum required overall percentage of marks, he/she has to repeat the examination till the minimum required overall percentage of marks are obtained.

8 *Grading*

8.1 The total of the internal evaluation marks and final University examination marks in each course will be converted to a letter grade on a ten-point scale as per the following scheme:

Table: Grading Scheme (UG)

Range of Marks (%)	≥80	**≥73 <80**	**≥66 <73**	**≥60 <66**	**≥55 <60**	**≥50 <55**	**≥45 <50**	**<45**
Letter Grade	AA	AB	BB	BC	CC	CD	DD	FF
Grade Point	10	9	8	7	6	5	4	0

8.2 The student's performance in any semester will be assessed by the Semester Grade Point Average (SGPA). Similarly, his performance at the end of two or more consecutive semesters will be denoted by the Cumulative Grade Point Average (CGPA). The SGPA and CGPA are calculated as follows:

(i) SGPA = $\Sigma C_i G_i / \Sigma C_i$ where C_i is the number of credits of course i
G_i is the Grade Point for the course i
and i = 1 to n, n = number of courses in the semester

(ii) CGPA = $\Sigma C_i G_i / \Sigma C_i$ where C_i is the number of credits of course i
G_i is the Grade Point for the course i
and i = 1 to n, n = number of courses of all semesters up to which CGPA is computed.

9. *Award of Class*

The class awarded to a student in the programme is decided by the final CGPA as per the following scheme:

Award of Class	**CGPA Range**
First Class with Distinction	CGPA ≥ 7.50
First class	7.50 > CGPA ≥ 6.00
Second Class	6.00 > CGPA ≥ 5.00
Pass Class	5.00 > CGPA ≥ 4.50

Grade sheets of only the final semester shall indicate the class. In case of all the other semesters, it will simply indicate as Pass / Fail.

10. Detention Criteria

- No student will be allowed to move further in next semester if CGPA is less than 3 at the end of an academic year.
- A Student will not be allowed to move to third year if he/she has not cleared all the courses of first year.
- A student will not be allowed to move to fourth year if he/she has not cleared all the courses of first and second year.

11. Transcript

The transcript issued to the student at the time of leaving the University will contain a consolidated record of all the courses taken, credits earned, grades obtained, SGPA,CGPA, class obtained, etc.

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY (CHARUSAT)

FACULTY OF TECHNOLOGY & ENGINEERING (FTE)

CHOICE BASED CREDIT SYSTEM

FOR

BACHELOR OF TECHNOLOGY & ENGINEERING

CHOICE BASED CREDIT SYSTEM

With the aim of incorporating the various guidelines initiated by the University Grants Commission (UGC) to bring equality, efficiency and excellence in the Higher Education System, Choice Based Credit System (CBCS) has been adopted. CBCS offers wide range of choices to students in all semesters to choose the courses based on their aptitude and career objectives. It accelerates the teaching-learning process and provides flexibility to students to opt for the courses of their choice and / or undergo additional courses to strengthen their Knowledge, Skills and Attitude.

1. CBCS – Conceptual Definitions / Key Terms (Terminologies)

Types of Courses: The Programme Structure consist of 4 types of courses: Foundation courses, Core courses, Elective courses and Non-credit (audit) courses.

1.1. Foundation Course

These courses are offered by the institute in order to prepare students for studying courses to be offered at higher levels.

1.2. Core Courses

A Course which shall compulsorily be studied by a candidate to complete the requirements of a degree / diploma in a said programme of study is defined as a core course. Following core courses are incorporated in CBCS structure:

A. **University Core courses(UC)**:

University core courses are compulsory courses which are offered across university and must be completed in order to meet the requirements of programme. Environmental science will be a compulsory University core for all Undergraduate Programmes.

B. **Programme Core courses(PC)**:

Programme core courses are compulsory courses offered by respective programme owners, which must be completed in order to meet the requirements of programme.

1.3. Elective Courses

Generally, a course which can be chosen from a pool of courses and which may be very specific or specialised or advanced or supportive to the discipline of study or which provides an extended scope or which enables an exposure to some other discipline / domain or nurtures the candidates proficiency / skill is called an elective course. Following elective courses are incorporated in CBCS structure:

A. **University Elective Courses(UE)**:

The pool of elective courses offered across all faculties / programmes. As a general guideline, Programme should incorporate 2 University Electives of 2 credits each (total 4 credits).

B. **Institute Elective Course (IE)**

Institute ekective courses are those courses which any students of the University/Institute of a Particular Level (PG/UG) will choose as offered or decided by the University/Institute from time-to-time irrespective of their Programme /Specialisation

C. **Programme Elective Courses(PE)**:

The programme specific pool of elective courses offered by respective programme.

D. **Cluster Elective Course (CE):**

An 'Elective Course' is a course which students can choose from the given set of functional course/ Area or Streams of Specialization options (eg. Common Courses to EC/CE/IT/EE) as offered or decided by the Institute from time-to-time.

1.4. Non Credit Course (NC) - AUDIT Course

A 'Non Credit Course' is a course where students will receive Participation or Course Completion certificate. This will be reflected in Student's Grade Sheet but the grade of the course will not be consider to calculate SGPA and CGPA. Attendance and Course Assessment is compulsory for Non Credit Courses.

1.5. Medium of Instruction

The Medium of Instruction will be English.

Vision
To provide state of art education in mechanical engineering supported by research and development to cater industrial and social needs.

Mission
To nurture mechanical engineers with strong theoretical foundation, hands-on experience, and high moral and ethical values for the betterment of lives.

To provide an academic environment to demonstrate critical thinking and leadership qualities needed for the development of productive career.

To develop and maintain facilities for continued education, training, research and development in the field of mechanical engineering.

Program Educational Objectives:

1. To develop students with academically rich background with extensive and intensive development of knowledge and skills with an uncompromising attitude towards excellence in the chosen field in the industry and further studies.

2. To develop the technical ability of the students through exposure to Material Sciences, Production Technology, Thermal Engineering, Fluid Mechanics and Computer Aided Design and Manufacturing.

3. To train the students and impart software skills, product design and development, integration of systems to develop cost effective and green technology.

4. To imbibe moral and ethical values with thorough professionalism and motivate the students towards overall personality development and encourage them towards entrepreneurial thinking.

5. To enhance verbal communication, provide a conducive environment for futuristic thinking for a successful professional career.

Program Outcomes: Mechanical Engineering

PO1 Graduates will demonstrate the knowledge of engineering fundamentals, mathematics, science and engineering specialization to solve complex engineering problem.

PO2 Graduates will exhibit the ability to design, identify, analyze and solve problems related to mathematics, science and engineering.

PO3 Graduates will exhibit the ability to design, solve and develop processes or systems which are cost effective, technologically advanced and meets public health, safety and environmental challenges.

PO4 Graduates will demonstrate ability to design and conduct experiments, analyze and interpret data through simulations to arrive at valid conclusions.

PO5 Graduates will demonstrate the skills to use modern methods of engineering, software tools, high-tech equipment's and facilities to solve various problems.

PO6 Graduates will display their abilities in undertaking problems of technological significance with a motive to serve the society.

PO7 Graduates will demonstrate ability to provide professional engineering solution in the contents of societal and environmental sustainability.

PO8 Graduates will exhibit responsibility in ethical and social issues.

PO9 Graduates will demonstrate the ability to work as an individual, and as a member or leader in diverse team and in multi-disciplinary settings.

PO10 Graduates will be effective in formal and informal communication in both verbal and written form and develop managerial skills.

PO11 Graduates will demonstrate the ability to work on multi-disciplinary problems through engineering and management principles.

PO12 Graduates will develop confidence for self-education and ability for life-long learning.

Program Specific Outcomes: Mechanical Engineering

PSO1 The mechanical engineering graduates will be able to analyze, design, and evaluate the performance of mechanical components and systems by using various technological tools.

PSO2 The mechanical engineering graduates will be able to plan and manufacture mechanical components and systems, including selection of material, method and process automation.

TEACHING & EXAMINATION SCHEME
B. TECH. PROGRAMME IN MECHANICAL ENGINEERING

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY (CHARUSAT) *(w.e.f. June 2018)*

Revised TEACHING & EXAMINATION SCHEME FOR THIRD YEAR B. TECH. PROGRAMME IN MECHANICAL ENGINEERING

Sem	Course Code	Course Title	Teaching Scheme				Examination Scheme				
			Contact Hours			Credit	Theory		Practical		Total
			Theory	Practical	Total		Internal	External	Internal	External	
SY Sem–5	ME 350	Thermal Engineering	3	0	3	3	30	70	00	00	100
	ME341	Design Concepts & Machine Drawing	4	2	6	5	30	70	25	25	150
	ME342	Heat & Mass Transfer	4	2	6	5	30	70	25	25	150
	ME343	Mechanical Vibrations	3	2	5	4	30	70	25	25	150
	ME37X	Programme Elective - I	3	2	5	4	30	70	25	25	150
	ME349	Summer Internship - I	-			3	00	00	75	75	150
	HS124.01A	Professional Communication	2		2	2	00	00	30	70	100
					27	**26**					**1000**
SY Sem–6	ME344	Refrigeration and Air Conditioning	3	2	5	4	30	70	25	25	150
	ME345	Mechanical Measurement & Metrology	3	2	5	4	30	70	25	25	150
	ME346	Fluid Machines	4	2	6	5	30	70	25	25	150
	ME347	Design of Machine Elements-I	3	0	3	3	30	70	00	00	100
	ME348	Production Technology	3	2	5	4	30	70	25	25	150
	HS134A	Contributor Personality Development	2		2	2	00	00	30	70	100
	ME37X	Programme Elective - II	3	0	3	3	30	70	00	00	100
					29	**25**					**900**

Programme Electives:

Sr. No.	Course Nature	Course Code	Course Title
1	Programme Elective-I	ME371	Internal Combustion Engines
2		ME373	Metal Casting Technology
3		ME376.01	Instrumentation & Control
4	Programme Elective-II	ME372.01	Finite Element Methods
5		ME374	Automobile Engineering
6		ME375	Advanced Materials

B. Tech. (Mechanical Engineering) Programme

SYLLABI

(Semester – 5)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

ME 350 THERMAL ENGINEERING

5^{th} Semester and 3^{rd} Year

Credit Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	0	3	3
Marks	100	0	100	

A. Objective of the Course:

- To share the knowledge related to energy and its sources with emphasis on energy conversion and transmission to mechanical energy.
- To analyze and evaluate various thermodynamic cycles used for energy production – work and heat, within the natural limits of conversion.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Vapour Power Cycles	12
2.	Gas Power Cycles	09
3.	Fuels and Combustion	09
4.	Heat Engine and Internal Combustion Engine	11
5.	Cryogenic Systems	04

Total hours (Theory): 45

Total: 45

C. Detailed Syllabus:

1 Vapour Power Cycles **12 Hours 27%**

1.1 Carnot Vapour Power Cycle, Rankine Cycle

1.2 Mean Temperature of Heat Addition, Capacity of Steam Power Plant

1.3 Modified Rankine Cycle, Comparison of Rankine and Carnot Cycles.

1.4 Deviation of Actual Cycle from Ideal Cycle.

1.5 Reheat Cycle, Ideal Regenerative Cycles, Reheat–Regenerative Cycle.

1.6 Regenerative Feed heating cycle, Open Feed Water heater, Closed Feed Water Heater, Multi Stage Regenerative Cycles.

1.7 Carnotization of Rankine Cycle, Optimum Degree of Regeneration, Binary Vapour Power Cycle, Mercury Steam Binary Vapour Power Cycle.

1.8 Thermodynamics of Coupled Cycles, Process heat and By–Product Power (back pressure turbine), Exergy Analysis of Vapour Power Cycle.

2 Gas Power Cycles **09 Hours 20%**

2.1 2.1 Introduction, Carnot Cycle, Stirling Cycle (Regenerative Cycle), Ericsson Cycle

2.2 2.2 Air Standard Otto Cycle, Air Standard Diesel Cycle

2.3 2.3 Limited Pressure Cycle or Dual Cycle, Comparison of Otto, Diesel and Dual Cycles

2.4 2.4 Atkinson Cycle, Lenoir Cycle, Brayton Cycle (Simple Gas Turbine Cycle, Brayton – Rankine Combine Cycle

3 Fuels and Combustion **09 Hours 20%**

3.1 Introduction, Classification of Fuels, Solid, Liquid and Gaseous Fuels, Merits and Demerits of Solid, Liquid and Gaseous Fuels

3.2 Requirements of a good fuel, Chemical Structure of Petroleum, Properties required for SI and CI engine fuels, Rating of IC engine fuels

3.3 Biofuels: Classification, Bioethanol – Merits, Demerits, Methods of producing Bioethanol, Biodiesel – Merits, Demerits, Methods of producing Biodiesel

3.4 Jatropha – an important Biodiesel Plant, Calorific Value of Fuels ,Higher Calorific Value, Lower Calorific Value, Experimental determination of HCV , Bomb Calorimeter, Boy's Gas Calorimeter

3.5 Combustion Equations of Solid Fuels, Combustion Equations of Gaseous Fuels, Theoretical or Minimum Air required for complete combustion of Solid Fuels and Gaseous Fuels

3.6 Mass of Carbon in flue gases, Mass of Flue Gases per kg of Fuel, Excess Air Supplied, Flue Gas Analysis by Orsat Apparatus

4 Heat Engine and Internal Combustion Engine **11 Hours 25%**

4.1 Introduction, Energy Conversion, definition of Engine, definition of heat engine, Elements of Heat Engine, Classification of Heat engine, Comparison between External and Internal Combustion Engine, Classification of IC Engines, Application of IC engine

4.2 Engine performance parameters: Bore, Stroke, Top Dead Centre, Bottom Dead Centre, Clearance Volume, Swept Volume, Compression Ratio, Indicated and brake Mean Effective Pressure, Mean Piston Speed, Specific Power Output, Specific Fuel Consumption, Indicated power, Frictional Power, Brake power, Inlet–Valve Mach Index, Fuel–Air (F/A) or Air–Fuel Ratio (A/F)

Indicated Thermal Efficiency, Brake Thermal Efficiency, Mechanical Efficiency, Volumetric Efficiency, Relative Efficiency or Efficiency Ratio

4.3 Comparison of Air standard and air fuel, Effect of operating variable on Air fuel cycle, difference between Air–Fuel cycle and Actual cycle

4.4 Indicator Diagram, Heat balance sheet of IC Engine

4.5 Various Systems in IC Engines

4.6 SI Engines and CI Engines, Different Parts of IC engines, Valve Timing diagram of IC Engine, Comparison between 2 stroke and 4 stroke engine, Comparison between SI and CI Engine

4.7 Supercharging and Turbo charging of IC engine, Objectives of supercharging, Effect of Supercharging on SI and CI engine

5 Cryogenic Systems **04 Hours 08%**

5.1 Mechanical Properties at low temperatures. Properties of Cryogenic Fluids. Applications of Cryogenic fluids.

5.2 Gas Liquefaction

D. **Instructional Methods and Pedagogy:**

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- In the lectures discipline and behavior will be observed strictly.

E. **Student Learning Outcomes / objectives:** Upon successful completion of this course, the student will be able to;

1. Understand concepts of thermal engineering systems.
2. Apply principles of thermal engineering to enhance the performance of energy conversion systems.
3. Identify, solve and analyze problems related to energy conversion.
4. Students will be able to understand the various aspects of energy utilization.
5. Understand the working principles to achieve cryogenic temperature.
6. Apply the knowledge of classical thermodynamics to different cryogenic technologies.
7. Classify various fuels and select proper fuel for combustion applications.

8. Analyses exhaust and flue gases.
9. Understand the various aspects of IC engines principles and its performance.

F. Recommended Study Material:

Text Books:

1. Nag P. K., "Engineering Thermodynamics", Tata Mc Graw–Hill publications. Fifth edition.
2. Cengel Yunus A, "Thermodynamics an engineering approach", Tata McGRAW Hill Publications. Eighth edition
3. Ganeshan. V, "Internal Combustion Engine", Tata Mc–Graw–Hill. Fourth edition.

Reference Books:

1. Rudramoorthy R, "Thermal Engieering", Tata Mcgraw–Hill publications
2. Arora and Domkundwar, "Power Plant Engineering", Dhanpat Rai Publications
3. Rajput. R. K. "Internal Combustion Engine", Laxmi Publications
4. Patel. R. C. "Elements of Heat engine" vol 1,2 and 3, Acharya Publications
5. Sarkar. B , "Thermal Engieering", Tata Mc Graw – Hill publications.
6. Rao Y. V. C., "Theory and Problems of Thermodynamics", Wiley Eastern Ltd
7. Klaus, D. T. and Thomas, F. M., "Cryogenic Process Engineering", Plenum Press, 2001.

Web material:

1. www.howstuffworks.com
2. http://www.wikipedia.org
3. http://www.fing.edu.uy/if/mirror/TEST/testhome/indexstates.html

Other materials

1. Mechanical Engineering (IE)
2. Sadhna (Engineering Sciences) www.ios.ac.in/sadhna
3. Steam Tables
4. Compressibility Chart
5. Proceeding of combustion institute
6. Experimental Thermal and Fluid Science
7. International Journal of Thermal Science

ME – 341 DESIGN CONCEPTS & MACHINE DRAWING

5^{th} Semester and 3^{rd} Year

Credit Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	2	6	5
Marks	100	50	150	

A. Objectives of the Course:

- To understand general procedure of machine design and remember different properties of engineering materials.
- To evaluate the solution of fundamental machine element problems under different loading conditions.
- To apply a variety of failure theories for design and/or analysis.
- To evaluate the crippling load that can be applied to long and short columns.
- To remember the use of computer aided drafting tools for the futuristic design and also understand the Industrial Drawing.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Design Consideration and Engineering Materials	03
2.	Concepts of Mechanics of Solids	09
3.	Riveted and Welded Joints	12
4.	Threaded and Bolted Joints	05
5.	Cotter and Knuckle Joints	06
6.	Column And Struts	04
7.	Lever Design	04
8.	Spring Design	04
9.	Production Drawings	07
10.	Computer Aided Drafting	06

Total hours (Theory): 60

Total hours (Lab): 30

Total: 90

C. Detailed Syllabus:

A	**Machine Design**		
1	**Design Consideration and Engineering Materials**	03 Hours	05%
1.1	Definition ,classification and general design procedure		
1.2	Classification and Mechanical Properties of materials		
2	**Concepts of Mechanics of Solids**	09 Hours	15%
2.1	Types of Axial, Bending, and Torsional loading and stresses		
2.2	Principal stresses and principal planes concept		
2.3	Theories of Failures and Selection and use of Theories of Failures		
2.4	Curved Beams and combined loading situations in Machine parts		
3	**Riveted and Welded joints**	12 Hours	20%
3.1	Methods of riveting, materials, types of rivets		
3.2	Important terms used for rivets, caulking and fullering		
3.3	Design of rivets		
3.4	Eccentric loaded riveted joints		
3.5	Types of weld joints and symbols		
3.6	Strength of welded joints		
3.7	Stresses of welded joints		
3.8	Axially loaded unsymmetrical and eccentric loaded welded joints		
4	**Threaded and Bolted joints**	05 Hours	08 %
4.1	Types of screw thread and its terminology		
4.2	Stresses in screwed fastening due to static loading		
4.3	Bolted joint under eccentric loading		
5	**Cotter and Knuckle Joints**	06 Hours.	10 %
5.1	Types of cotter joint and its design		
5.2	Design of cotter foundation bolt		
5.3	Design of knuckle joints		
6	**Column and Struts**	04 Hours.	07 %

6.1	Compressive axial loading of columns and struts, Slenderness ratio		
6.2	Compressive stress and Buckling of members, Effect of end conditions		
6.3	Euler's Formula, Applications, validity and limitations		
6.4	Rankine's Formula		
7	**Lever Design**	**04 Hours.**	**07 %**
7.1	General Procedure for design of levers		
7.2	Design of lever for safety valve, design of bell crank lever		
7.3	Design of rocker arm for exhaust valves		
8	**Spring Design**	**04 Hours.**	**07%**
8.1	Design of spring, buckling, surge in spring		
8.2	Spring in series and parallel, concentric and composite spring		
8.3	Design of leaf spring		
B	**Machine Drawing**		
9	**Production drawings**	**07 Hours.**	**11 %**
9.1	Limits, fits and tolerances		
9.2	Geometric tolerances		
9.3	Surface texture		
9.4	Shop floor drawing		
10	**Computer aided drafting**	**06 Hours**	**10 %**
10.1	Introduction to CAD		
10.2	Use of CAD software and relevant commands		
10.3	Drafting of 2-D drawing in Auto-CAD software		

D. Instructional Methods and Pedagogy

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for

the concepts being taught in lectures.

- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Student Learning Outcomes:

On successful completion of the course, the student will be able to:

1. Understand general procedure of machine design and recall different properties of engineering materials.
2. Analyze an appropriate failure theory for design and/or analysis for curved beam, cotter joint, knuckle joint, welded joints, and riveted joints.
3. Evaluate the solution of fundamental machine element problems under different loading conditions like lever design, spring design.
4. Calculate the crippling load that can be applied to long and short columns.
5. Illustrate the use of computer aided drafting tools for the futuristic design and also interpret the Industrial Drawing.

F. Recommended Study Material:

Text Books:

1. Bhandari V B, “Design of Machine Elements”, Tata McGraw Hill publishing Co.
2. Pandya N and Shah C, “Machine Design”, Charotar Publishers.

Reference books:

1. Sharma P. C , Aggarwal D. K. “ Machine Design”, S.K. Kataria & Sons, 2009.
2. Bhatt N. D., “Machine Drawing”, Charotar Publication.
3. Shigley Joseph Edward , Mischke Charles R., "Mechanical Engineering Design", McGraw Hill International Edition.
4. Hibbler R. C., “Mechanics of Materials”, Pearson Education, Inc., 2017.
5. Gere J M and Goodno B J, “Mechanics of Materials”, CENGAGE learning
6. Orthein William, "Machine Component Design (Vol. I & II)", M/s. Jaico Publishing.
7. Kulkarni S. G., “Machine Design – Solved Problems", Tata McGraw Hill Publishing Company Ltd., New Delhi
8. Sham Tickoo, “AutoCAD”, and CENGAGE learning Indian Edition.

Reading Materials, web materials with full citations:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1/New_index1.html
2. PSG Design data book

Other materials

Software: Computer Aided Drafting Packages/software like AutoCAD, Pro–Engineer etc.

Journals:

1. Mechanical Engineering (IE)
2. Sadhna (Engineering Sciences) www.ios.ac.in/sadhna
3. Materials and Design, ELSEVIER Journal

ME – 342 HEAT & MASS TRANSFER

5^{th} Semester and 3^{rd} Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	2	6	5
Marks	100	50	150	

A. Objectives of the Course:

- To give students a reasonable overview of heat transfer and mass transfer.
- To make aware the students about the several modes of heat transfer and their physical origins.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction	02
2.	Heat Conduction	19
3.	Convective Heat Transfer	12
4.	Thermal Radiation	10
5.	Heat Exchangers	10
6.	Mass Transfer	04
7.	Boiling and Condensation	03

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1 Introduction 02 Hours 05%

1.1 Basic modes of Heat transfer, Introduction to laws, some heat transfer parameters.

2 Heat Conduction 19 Hours 30%

2.1 Thermal conductivity and other relevant properties. Fourier's law. General three dimensional heat conduction equation in Cartesian, Cylindrical and Spherical co – ordinates.

2.2 One dimensional, heat conduction without and with heat generation through plane slabs, cylinders and spheres. Transient Conduction: The Lumped Capacitance Method

2.3 Concept of thermal resistance, Electrical analogy, Heat transfer through composite slabs, cylinders and spheres, contact resistance.

2.4 Critical thickness of insulation for cylinder and sphere.

2.5 Heat transfer from finned surfaces, general equation, Efficiency and effectiveness of fins. Transient conduction, Lumped capacitance model, One dimensional transient problem – analytical solutions, One dimensional Heisler charts.

3 Convective Heat Transfer 12 Hours 25%

3.1 Convective Heat Transfer coefficient, Energy equation, Thermal boundary layer, dimensional analysis.

3.2 Forced Convection: Blausius solution for laminar boundary layer flows, Van–Karman integral momentum equation, and Energy equation of thermal Boundary layer over a flat plate, Approximate solution of energy equation, Laminar Tube flow, Turbulent boundary layer, Turbulent flow over flat plate and in tubes.

3.3 Free Convection: Momentum and Energy equation for laminar flow over flat plate, Integral equation for momentum and energy on a flat plate, Empirical relations and their use.

4 Thermal Radiation 10 Hours 20%

4.1 Concept of radiation, surface emission properties, absorptivity, reflectivity and transmissivity, black, white and grey surfaces.

4.2 Laws of radiation – Planck, Stefan Boltzman, Wein's displacement, Kirchoff. Intensity of radiation and solid angle, Lambert's cosine law, shape factor.

4.3 Radiation exchange between non black bodies, radiation shield, heat exchange between two grey surfaces, electrical analogy.

5 Heat Exchangers 10Hours 10%

5.1 Heat exchanger types, flow arrangements, overall heat transfer coefficient, fouling factor, LMTD for parallel flow and counter flow heat exchangers.

5.2 Effectiveness– NTU method, expression for effectiveness of a parallel flow and counter flow heat exchangers. Multi–pass and cross flow heat exchangers.

6	**Mass Transfer**	**04 Hours**	**05%**
6.1	Analogy between heat and mass transfer, Fick's law of diffusion, Mass transfer coefficient, Evaporation of water into air, Schmidt number, Sherwood number.		
7	**Boiling and Condensation**	**03 Hours**	**05%**
7.1	Different regimes of boiling, mechanism of condensation, Nusselt's theory of film condensation on a vertical surface, use of correlations in solving film wise condensation on plane surfaces, horizontal tubes and tube banks.		

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

On successful completion of the course, the student will be able to:

1. Understand the basic laws of heat transfer as well as ability to understand and solve conduction, convection and radiation problems.
2. Analyze problems involving steady state heat conduction in simple geometries.
3. Understand the fundamentals of convective heat transfer process.
4. Ability to design and analyze the performance of heat exchangers using LMTD and NTU method.
5. Understand and analyze heat transfer through extended surfaces.
6. Examine thermal conductivity of different geometries.
7. Analyze unsteady state heat conduction using experimental setup

F. **Recommended Study Material:**

Text Books:

1. Kumar D. S. “Heat and Mass Transfer” S. K. Kataria and Sons,2015
2. Holman J. P., “Heat Transfer”, McGraw Hill, 2009.
3. Sukhatme S. P., “Heat Transfer”, Universities Press (India), 2005.

Reference Books:

1. Sachdeva R. C. “Fundamentals of Engineering Heat and Mass transfer” New Age International, 2017.
2. Yunus A Cengel. “Heat & Mass Transfer” McGraw Hill, 2014.
3. E.R.G. Eckert and Robert M. Drake, “Heat and Mass Transfer”, McGraw Hill, 1996.
4. Chapman A. J., “Heat Transfer”, Macmillan, New York, 2000.
5. Kothandraman. C. P., “Fundamentals of Heat and Mass transfer”, New Age International, 2012.

Web Material:

1. http://www.nptel.iitm.ac.in/

Other Material:

1. SADHNA (Engineering Science): http://www.ias.ac.in/sadhana/
2. www.sciencedirect.com(International journal of Heat and fluid flow)

ME – 343 MECHANICAL VIBRATIONS

5^{th} Semester and 3^{rd} Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objectives of the Course:

- Appreciating the need and importance of vibration analysis in mechanical design of machine parts that operate in vibratory conditions.
- To learn theory, computational aspects and applications of vibrations.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction to Mechanical Vibration	01
2.	Free Vibrations of Single Degree Freedom Systems	10
3.	Harmonically Excited Vibration	13
4.	Two Degrees of Freedom and Multi–degree of Freedom Systems	13
5.	Natural Frequencies and Mode shape	03
6.	Continuous Systems	03
7.	Vibration Measuring Systems	02

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1 Introduction **01 Hours 02%**

1.1 Importance of Vibration, Basic concepts of Vibration, Classification of vibration, Harmonic motion and Harmonic analysis

2	**Free Vibrations of Single Degree Freedom Systems**	**10 Hours**	**24%**
2.1	Free vibration of undamped Translational system		
2.2	Free vibration of undamped Torsional system		
2.3	Free vibration with viscous damping, Coulomb damping and hysteretic damping		
3	**Harmonically Excited Vibration**	**13 Hours**	**29%**
3.1	Response of an undamped system under harmonic force		
3.2	Response of an damped system under harmonic force , Response of an damped system under harmonic motion of the base and under rotating unbalance		
3.3	Forced vibration with Coulomb damping and hysteretic damping		
4	**Two Degrees of Freedom and Multi-Degree of Freedom Systems**	**13 Hours**	**29%**
4.1	Free un-damped vibrations – Principal modes and natural frequencies, Co-ordinate coupling and principal co-ordinates		
4.2	Forced vibrations (Undamped) – Harmonic excitation, Vibration, Dampers and absorbers, Dynamic vibration absorber – Tuned and Untuned type		
4.3	Multi-degree of Freedom Systems		
5	**Natural Frequencies and Mode shape**	**03Hours**	**06%**
5.1	Dunkerley's formula, Rayleigh's method, Hozler's method, Matrix method.		
6	**Continuous Systems**	**03 Hours**	**06%**
6.1	Transverse vibration, Longitudinal vibration , Torsional vibration		
7	**Vibration Measuring Systems**	**02Hours**	**04%**
7.1	Instruments for measurement of displacement, velocity, acceleration and frequency of vibration, Sensors and Actuators, Introduction of X – Y plotter, Spectral analyzers, FFT analyzer.		

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, etc.
- Attendance is compulsory in lectures and laboratory.

- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

On successful completion of the course, the student will be able to:

1. Understand important of vibration in design and construct the equations of motion from free-body diagrams.
2. Formulate an equation of motion and calculate the natural frequency of single degree of freedom free undamped and damped vibration.
3. Construct the governing differential equation and its solution for a vibrating mass subjected to a different force conditions.
4. Solve vibration problems that contain two degree of freedom and multiple degrees of freedom.
5. Understand about different numerical method use to solve vibration problem.
6. Obtain design parameters and indicate methods of solution for a complicated continuous vibration problem and different vibration measurement instrument.

F. Recommended Study Material:

Text Books:

1. Rao S. S., "Mechanical Vibrations", Prentice Hall, 6th edition,2016.
2. Grover G. K, "Mechanical Vibrations", Nem Chand and Brothers 8th Edition,2009.

Reference Books:

1. Singh V. P., "Mechanical Vibration", S. Chand and Sons New Delhi, 4th edition,2014.
2. Ambekar A. G., "Mechanical vibration and noise engineering", Prentice Hall, 1st edition,2006.
3. Inman D.J., "Engineering Vibration",Pearson Publication, 3rd Edition,2007.
4. Kelly S. Graham, "Mechanical Vibrations– Schaum's Outline Series," Tata McGraw Hill, Special Indian Edition, 2007.
5 Kelly S. Graham, "Mechanical Vibrations- Theory and application" Cengage Learning, 1st Edition, 2012.

6 Singh V. P., “Mechanical Vibration”, S. Chand and Sons New Delhi, 4th edition,2014.

Web Material:

http://www.nptel.iitm.ac.in/

http://mdmv-nitk.vlabs.ac.in/

Other Material:

1. SADHNA (Engineering Science): http://www.ias.ac.in/sadhana/
2. IE Mechanical Engineering
3. Mechanical Systems and Signal Processing (Science Direct Journal)

HS-124.01A PROFESSIONAL COMMUNICATION

5th Semester and 3rd Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	00	100	100	

A. Objectives of the Course:

- To hone and sharpen Professional Communication Skills of students
- To prepare globally and multi-culturally competent communicators and professionally compatible cadre of future professionals
- To equip and empower students to qualify and successfully clear all the phases of selection procedure for on and off campus interviews

B. Outline of the Course:

Module No.	Title/Topic	Classroom Contact Sessions
1	**An Introduction Professional Communication** • *Concept & Applications of Professional Communication* • *Rhetoric in Professional Communication* • *Importance of Ethos, Logos, and Pathos in Professional Communication*	03
2	**Cross-cultural Communication and Globalization** • *Basic Concepts: Culture, Globalization andCross-cultural Communication* • *Social and People Skills* • *Communicating with People of Different Cultures* • *Conflicts in Cross-cultural Communication and Tactics / techniques to resolve them*	08

3	**Group Discussion and Personal Interviews** • *Cover Letters and Resume* • *Styles, Formats and Content of Cover Letters* • *Types of Resume* • *Concept and Rationale of Group Discussion* • *Skills and Aspects assessed in Group Discussion* • *Concept and Rationale of Personal Interview* • *Types of Personal Interview*	**10**
4	**Group Dynamics and Leadership** • *An Introduction to Group Dynamics and Leadership* • *Groups and their Structures* • *Roles and Functions of Members in Groups* • *Leading a Group* • *Types of Leadership/Leaders* • *Roles and Functions of a Leader* • *Characteristics of an effective Leader*	**05**
5	**Statement of Purpose (SOP)** • Concept and Rationale of Statement of Purpose • Statement of Purpose as a part of Selection Process • Types, Format and Nature of Statement of Purpose • Content and Process of Statement of Purpose	**04**
	Total	**30**

C. Pedagogy

Teaching will be facilitated by reading material, discussions, task-based learning, projects, assignments and interpersonal activities like group work, independent and collaborative study projects and presentations, etc.

D. Evaluation

Internal Evaluation

Students' performance in the course will be evaluatedon a continuous basis through the following components:

Sr. No.	Component	Number	Marks per incidence	Total Marks
1	Assignment	02	05	10
2	Project	01	15	15
3	Attendance			05
			Total	30

External Evaluation

University Practical Examination will be for 70 marks to be conducted at the end of the semester. Details are:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Practical / Viva	01	70	70
			Total	70

E. Learning Outcomes

After successfully passing through this course, the students would have –

1. Gained thorough understanding and proficiency in various Professional Communication Skills.
2. Developed awareness and competence in cross-cultural communication in their personal, academic and professional environments.
3. Been empowered and confident to prepare impressive RESUMEs, and crack further phases of interview successfully.

F. Reference Books

- Koneru, A. *Professional Communication*, Tata McGrow Hill Education Private Limited
- Disanza, J.R. &Legge, N. *Business and Professional Communication*, Pearson Education
- Anandamurugan, A. *Placement Interviews – Skills for Success*, Tata McGrow Hill Education Private Limited
- Raman, M & Singh, P. *Business Communication*, Oxford University Press
- Adair, J. *Adair on Leadership*, CREST Publishing House

B. Tech. (Mechanical Engineering) Programme

SYLLABI
(Semester – 6)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

ME – 344 REFRIGERATION AND AIR–CONDITIONING

6th Semester and 3rd Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objectives of the Course:

- The course provides the deep understanding of the principles and methods of Refrigeration and Air Conditioning.
- The course contents help for studying the design and applications of Refrigeration and Air Conditioning in domestic, commercial and industrial sector.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Basic Concepts	2
2.	Refrigerants	2
3.	Air Refrigeration	2
4.	Vapour Compression Refrigeration Cycle	9
5.	Refrigeration System components	3
6.	Vapour Absorption Refrigeration Cycle	6
7.	Psychometry	7
8.	Psychometric Processes	7
9.	Human Comfort	3
10.	Air conditioning systems	4

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1	**Basic Concepts**	**02 Hours**	**04%**
1.1	Natural and Mechanical refrigeration, Application of Refrigeration, Units of refrigeration and Coefficient of Performance (COP), Refrigeration effect, cooling capacity and COP of a refrigerator.		
1.2	Heating effect, heating capacity and COP as heat pump, Reversed Carnot cycle and its limitations.		
2	**Refrigerants**	**02 Hours**	**05%**
2.1	Classification and nomenclature of refrigerants.		
2.2	Desirable thermodynamic, chemical and physical properties of refrigerants;		
2.3	Comparative study of commonly used refrigerants and their fields of application; Azeotropes, ODP & GWP; Secondary refrigerants; future industrial refrigerants.		
3	**Air Refrigeration**	**02 Hours**	**05%**
3.1	Introduction, Air refrigerator working on Reversed Carnot cycle and Bell Coleman Cycle with their C.O.P of cycles.		
3.2	Numerical of air refrigeration system.		
4	**Vapour Compression Refrigeration Cycle**	**09 Hours**	**20%**
4.1	Vapour compression cycle on P-V, P-H and T-S diagrams, Deviation of actual cycle from theoretical cycle, Analysis of theoretical and actual Vapour compression cycles.		
4.2	Effect of suction pressure, discharge pressure, sub cooling, super heating and pressure drop in valves on performance and cooling capacity.		
5	**Refrigeration system components**	**03 Hours**	**06%**
5.1	Types; construction; working; comparison of Compressors; condensers; expansion devices; and evaporators, evacuation and charging of refrigerant.		
6	**Vapour Absorption Refrigeration Cycle**	**06 Hours**	**13%**
6.1	Principle of absorption system, Simple Vapour absorption refrigeration system, C.O.P of ideal Vapour absorption refrigeration system.		
6.2	Desirable properties of absorption system refrigerants and absorbents.		
6.3	Aqua-ammonia absorption refrigeration system, Lithium bromide-water absorption refrigeration system; comparison between Vapour compression and absorption refrigeration		

system.

6.4 Numerical of Vapour absorption refrigeration system.

7 Psychrometry **07 Hours 16%**

7.1 Psychrometry properties of air, Dry bulb, Wet bulb and Dew point temperatures; Relative and specific humidity; Degree of saturation; Adiabatic saturation temperature; Enthalpy of air and water vapors; Psychometric chart.

7.2 Numerical on Psychrometry.

8 Psychometric Processes **07 Hours 16%**

8.1 Sensible heating and cooling , Latent heating and cooling, Cooling with dehumidification, Cooling with humidification, Heating with dehumidification , Heating with humidification, By-pass factor, Chemical dehumidification, Adiabatic mixing , Air washer.

8.2 Numerical of psychometric processes.

9 Human Comfort **03 Hours 06%**

9.1 Factors affecting human comfort, effective temperature, factors affecting optimum effective temperature, Basics of Cooling load calculations.

10 Air Conditioning Systems **04 Hours 09%**

10.1 Air conditioning cycle, classification of air conditioning system, different central air conditioning systems, difference between packaged and central air conditioning plants.

10.2 Desert air cooler, window air conditioner, split air conditioner.

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. **Students Learning Outcomes:**

On successful completion of the course, the student will be able to:

1. Understand the principles and applications of refrigeration systems.
2. Evaluate performance of Vapour compression refrigeration system.
3. Apply working principle of VAR/VCR system to solve numericals based on VCR and VAR system.
4. Understand basics of psychrometry, air conditioning processes and different air conditioning systems.
5. Analyze different psychrometric processes on general cycle air conditioning trainer.

F. **Recommended Study Material:**

Text Books:

1. Arora C. P, "Refrigeration and Conditioning", Tata McGraw Hill Publication.
2. Prasad Manohar, "Refrigeration and Conditioning", Wiley Eastern Limited.
3. Desai P. S., "Modern Refrigeration and air Conditioning for engineers", Khanna Publications.

Reference Books:

1. Ananthanarayanan, "Refrigeration and Conditioning", Tata McGraw Hill Publication.
2. Rajput R. K., "Refrigeration and Conditioning", S. K. Kataria and sons publication.
3. Domkundwar and Arora, "Refrigeration and Air Conditioning", Dhanpat Rai & Co.
4. Jordan and Priester, "Refrigeration and Conditioning", Prentice Hall of India.
5. Stoecker W. F., "Refrigeration and Conditioning", Tata McGraw Hill Publication.

Web Material:

1. http://nptel.iitm.ac.in/video.php?courseId=1025

Other material:

1. ASHRAE Hand book (Fundamentals and Equipments)
2. International journal of refrigeration (www. sciencedirect.com)

ME 345: MECHANICAL MEASUREMENT & METROLOGY

6th Semester and 3rd Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objectives of the Course:

- To help students to learn, select and use different measuring instruments for measuring the qualitative and quantitative characteristics of different mechanical components.
- To help students to learn how to measure various parameters/quantities are associated with the practical jobs by selecting proper instruments and to take corrective action for minimizing and removing deviations.
- To ingrain the consciousness in students to calibrate the measuring instruments as per National and International Standards for precise measurement of the quantity.

B. Outline of the Course:

Sr. No.	Title of the Unit	Min. no. of Hrs.
1.	General Concepts and Errors in Measurement	07
2.	Linear Measurements	05
3.	Angular and Taper Measurements	05
4.	Screw Thread and Gear Measurements	07
5.	Measurement of Surface Finish	04
6.	Straightness, Flatness, Squareness, Parallelism and Machine Tool Tests	05
7.	Temperature and Pressure Measurement	07
8.	Miscellaneous Measurements	02
9.	Coordinate Measuring Machine	03

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1.	**General Concepts and Errors in Measurement**	**07 Hrs**	**16%**
1.1	Meaning, Necessity and Objectives of Metrology Classification of Measurements and Instruments, Standards of Measurement; Elements of Measuring System; Methods of Measurement		
1.2	Static and Dynamic Characteristics of Instruments, Range and span, accuracy and precision, calibration, hysteresis and dead zone, sensitivity and linearity, threshold and resolution; speed of response, lag, fidelity and dynamic error, dead time and dead zone.		
1.3	Calibration, Limits, fits tolerances and allowances, IS codes for limits and fits.		
1.4	Concept of errors, Sources of errors, Systematic and Random errors; Statistical analysis of data.		
1.5	Regression analysis, correlation, estimation of uncertainty and presentation of data.		
2	**Linear Measurements**	**05 Hrs**	**11%**
2.1	Introduction and classification of Linear Measuring Instruments; Least count; Engineer's Steel rule; Calipers; Vernier Caliper: working principle, construction, types and precautions to be taken; Vernier Height Gauge; Vernier Depth Gauge		
2.2	Micrometers: Principle, Construction, Sources of errors and precautions to be taken. Types of micrometers, Miscellaneous linear measuring instruments like bore gauge, Telescopic gauge, Slip gauges		
2.3	Dial Indicators: Construction and Working; Comparators; Calibration of various linear measuring instruments		
2.4	Applications, Advantages and Limitations of commonly used linear measuring instruments.		
3	**Angular and Taper Measurements**	**05 Hrs**	**11%**
3.1	Introduction; Working principle and construction of Angular Measuring instruments like Protractors, Sine bars, Sine Centre, Angle gauges, Spirit level, Clinometers, Angle dekkor, Applications, Advantages and Limitations of commonly used angular measuring instruments		
3.2	Taper Measuring Instruments: Measurement of taper shafts and holes.		
4	**Screw Thread and Gear Measurements**	**07 Hrs**	**15%**
4.1	Introduction and classification of Threads; Elements, Specification and Forms of Screw		

Threads

4.2	Various Methods for measuring elements of External and Internal Screw Thread; Screw Thread Gauges, Errors in Threads		
4.3	Introduction and Classification of gears; Forms of gear teeth; Gear tooth terminology		
4.4	Measurement and testing of spur gear: Various methods of measuring tooth thickness, tooth profile and pitch, Gear Errors.		
5	**Measurement of Surface Finish**	**04 Hrs**	**09%**
5.1	Introduction; Surface Texture; Methods of Measuring Surface finish, Methods of Surface Measurement		
5.2	Sample Length; Numerical Evaluation of Surface Texture; Indication of Surface roughness Symbols used; Adverse effects of poor surface finish.		
6	**Straightness, Flatness, Square ness, Parallelism and Machine Tool Tests**	**05 Hrs**	**11%**
6.1	Introduction; Measurement of Straightness, Flatness, Square ness and Parallelism; run out and concentricity		
6.2	Tool makers microscope; Interferometry and its use in checking flatness, surface contour, parallelism etc.; Interferometers and optical flats		
6.3	Introduction to Machine tool testing; Various Alignment test on lathe, Milling Machine, Drilling Machine etc.		
7	**Temperature and Pressure Measurement**	**07 Hrs**	**16%**
7.1	Introduction; Temperature and Temperature Scales; Methods of Temperature Measurement,		
7.2	Expansion Thermometers; Filled System thermometers; Electrical Temperature Measuring Instrument, Pyrometers; Calibration of Temperature Measuring Instruments.		
7.3	Introduction; Pressure standards and methods of pressure measurement; Manometers; Elastic pressure transducers; Measurement of Vacuum; Force balance pressure gauges; Electrical pressure transducers, Pressure Switches		
7.4	Calibration, Trouble shooting of pressure measuring instruments.		
8	**Miscellaneous Measurements**	**02 Hrs**	**04%**
8.1	Measurement of Force, Torque, Power, displacement, Velocity and Acceleration.		
9	**Coordinate Measuring Machine**	**03 Hrs**	**07%**

9.1 History of Coordinate Measuring Machines, Important feature of CMM and Applications

9.2 Operating Construction and working of CMM, Calibration of CMM , Possible causes of errors in CMM

9.3 Measuring type probes in computer controlled CMM

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

On successful completion of the course, the student will be able to:

1. Understand importance of precise measurement and role of accuracy in manufacture industries.
2. Execute statistical analysis of the measured data.
3. Analyze how different measurements techniques opting for specific properties like pressure, temperature, surface roughness etc.
4. Learn properties are important for further applications in subjects like Machine Design, Production and Manufacturing, Industrial Engineering, Fluid Power Engineering etc.

F. Recommended Study Material:

Text Books:

1. Rajput R.K., "Mechanical Measurements and Instrumentation", S. K. Kataria and Sons.
2. Jain R. K., "Engineering Metrology", Khanna Publisher, 2009.
3. Kumar D.S., "Mechanical Measurements and Control", Metropolitan, New Delhi,

4th Edition.
4. M.Mahajn, "A Textbook of Metrology", Dhanpat Rai & Co., Reprint 2015.

Reference Books:

1. Venkateshan S. P., "Mechanical Measurements", John Wiley & Sons Ltd, (2015).
2. B. C. Nakra and K. K. Chaudhry, "Instrumentation, Measurement and Analysis", Tata McGraw Hill Publication, (2004).
3. Richard S. Figliola and Donald E. Beasley, "Theory and Design for Mechanical Measurements", Wiley, 5th Edition (2010).
4. Tayal A. K., "Instrumentation Mechanical Measurement", Galgotia Publisher, 2nd Edition (2008).
5. Bewoor, Vinaykulkarni, "Metrology and Measurement", Tata McGraw Hill, 1st Edition (2009).

Web Material:

1. http://nptel.iitm.ac.in/courses/IITMADRAS/Mechanical_Measurements_Metrology/index.php

Other Material:

1. International Journal of Metrology and Quality Engineering, ISSN (Print Edition): 2107-6839,ISSN (Electronic Edition): 2107-6847,Frequency: 2 issues per year, Published by: EDP Science
2. M. Adithan and R. Bahn, "Metrology Lab", Manual T.T.T.I. Chandigarh
3. Sadhna: http://www.ias.ac.in/sadhana/
4. www.sciencedirect.com (Flow measurement and Instrumentation)

ME346 FLUID MACHINES

6th Semester and 3rd Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	2	6	5
Marks	100	50	150	

A. Objectives of the Course:

- To give students an elementary idea about applications of fluid mechanics concepts.
- To develop analytical abilities for evaluating the working of fluid machines.
- To make aware the students about the test methods for performance evaluation of fluid machines.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Hydropower Station	03
2.	Impact of Jet	15
3.	Hydraulic Turbine	20
4.	Pumps	18
5.	Miscellaneous Machines	04

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1. Hydropower Station **3 Hours 07%**

1.1 Principles of generation of hydropower, Components of the plant, Layout of plant, Various types of hydro power plants.

2 Impact of Jet **15 Hours 25%**

2.1 Impact of jet on different types of flat and curved plates

2.2 Fixed and moving, Single and series of plates

2.3 Derivation of efficiency, Condition for maximum efficiency and value of maximum efficiency, Hinged plate and pipe bends

3 Hydraulic Turbine 20 Hours 30%

3.1 Introduction and development of turbines, Classification of turbines, Impulse and reaction, Radial and axial, Tangential and mixed flow turbines

3.2 Major components of different turbines, Expressions for work done and efficiency of Pelton wheel, Bucket of Pelton wheel, Size and number of buckets, Single jet and Multi jet Pelton wheel

3.3 Francis turbine, Kaplan turbine and Propeller turbines, Construction, Working problems on each type

3.4 Specific speed, Range of specific speed for different turbines, Performance curves of turbine, Selection of turbines according to available head, Discharge and load, Governing of turbines.

4 Pumps 18 Hours 28%

4.1 Classification of pumps, centrifugal pump - velocity diagrams and work done by impeller, losses and efficiencies, pressure rise through impeller, specific speed, NPSH, cavitations, characteristics curves.

4.2 Reciprocating Pumps – Operation of single acting and double acting pump, plunger and buckets pumps, work done, slip

4.3 Ideal and actual indicator diagram, effect of velocity and acceleration on suction and delivery pipes, Maximum speed. Air vessels, Miscellaneous pumps like submersible pump, ejector pump etc.

5 Miscellaneous Machines 04 Hours 10%

5.1 Study of constructional details of hydraulic press, Hydraulic accumulator, Hydraulic intensifier. Hydraulic crane, Hydraulic jack.

5.2 Hydraulic lift, Hydraulic ram, Fluid couplings and Fluid torque converter.

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board etc.
- Attendance is compulsory in lectures.

- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.
- Industrial Visits will be organized for students to explore industrial facilities. Students are required to prepare a report on industrial visit and submit as a part of assignment

E. Students Learning Outcomes:

Upon successful completion of this course, the student will be able to:

1. Understand the fundamentals of the hydroelectric power plant & functions of its various components with detail exposure to its construction & operation.
2. Describe the principal parameters and the action of forces on various plates of different geometries by the impact of a fluid jet.
3. Predict the complete performance of the turbines theoretically and experimentally.
4. Understand the classification, working, construction, and various essential parameters about the system of the hydraulic pumps used in the industry.
5. Understand the principles of fluid statics and fluid kinematics of various power transmitting devices.

F. Recommended Study Material:

Text Books:

1. Bansal R. K., “A Text Book of Fluid Mechanics and Hydraulic Machines”, Laxmi Publications Pvt. Ltd.
2. Kumar D. S., “Fluid Mechanics and Fluid Power Engineering”, S K Kataria and Pub.

Reference Books:

1. Rajput R. K., “Fluid Mechanics and Hydraulic Machines”, S Chand and Co. Ltd.
2. Arora K. R., “Fluid Mechanics and Hydraulic Machines”, Standard Publishers and Distributors, 2005
3. Jagdish Lal, “Hydraulic”, Metropolitan Book Co., 1963
4. Patel V. L. and Patel R. N., “Fluid Power Engineering”, Mahajan Publications

Web Material:

1. http://www.nptel.iitm.ac.in/courses/Webcourse-contents/iitkanpur/machine/ui/ toc.html

Other Material:

- SADHANA (Engineering Science): http://www.ias.ac.in/sadhana/
- www.sciencedirect.com: World Pumps, Pump Industry Analysis.
- Institution of Engineers: http://www.ieindia.info/jourtechdwnlds.aspx

ME 347 DESIGN OF MACHINE ELEMENTS – I

6th Semester and 3rd Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	0	3	3
Marks	100	00	100	

A. Objectives of the Course:

- To teach students the concept of stress analysis, theories of failure to analyze design and /or select commonly used machine elements
- To develop skills for designing machine elements.
- To develop analytical and practical abilities for providing solutions to design of machine elements.
- To help recognize those factors constituting practical, functional, efficient and safe design of mechanical elements.
- To provide background for higher level courses in Mechanical Engineering.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of Hours
1.	Design consideration and Standardization	04
2.	Stress Analysis	08
3.	Power Screw	06
4.	Shaft, Keys, and Couplings	06
5.	Friction Clutches	04
6.	Brakes	04
7.	Belt and Chain Drives	07
8.	Cylinders and Pressure Vessel	06

Total Hours (Theory): 45

Total Hours: 45

C. **Detailed Syllabus:**

1	**Design Considerations and Standardizations**	**04 Hours**	**09%**
1.1	Introduction, Design Principles for Manufacture and Assembly, Design principles in Castings, Forgings. Machining, Powder Metallurgy and Welding.		
1.2	Introduction, Utility of standardization, Preferred numbers, Standard series and its Applications.		
2	**Stress Analysis**	**08 Hours**	**18%**
2.1	Modes of failure, Theory of Failure under static load, Selection, use and limitation of various failure theories.		
2.2	Residual stress, Stress concentration, Causes and Method of Reduction of stress Concentrations.		
2.3	Variable stresses, Endurance limits, Factor affecting on endurance limit, Notch Sensitivity.		
2.4	Soderberg and Goodman lines for design against fluctuating load.		
3	**Power Screw**	**06 Hours**	**13%**
3.1	Terminology, Torque requirement of lifting load and lowering load, Self-locking and Over–hauling Screw, Efficiency of screw.		
3.2	Design of screw and nut, Design of screw jack and toggle jack.		
3.3	Differential and compound screw, Reticulating ball screw.		
4	**Shaft, Keys, and Couplings**	**06 Hours**	**13%**
4.1	Shafts: Introduction, Materials used for shaft, Types of shaft, Standard sizes of shaft, Concept of strength and rigidity and Design of shaft		
4.2	Keys: Types of keys, Design of square and flat Key, Design of Kennedy key, Design of splines and Effect of keyways		
4.3	Couplings: Types of couplings, Design of rigid flange coupling and flexible couplings.		
5	**Friction Clutches**	**04 Hours**	**9%**
5.1	Classification, Materials for friction surfaces.		
5.2	Consideration in design of friction clutches, Design of single and multi-plate clutches		
5.3	Cone clutches, Centrifugal clutches.		

6 Brakes **04 Hours 9%**

6.1 Introduction, Energy equations.

6.2 Block brakes with short shoe and long shoe, Pivoted block with long shoe.

6.3 Internal expanding brakes, Simple band brake and differential band brake, Principle of disc brakes.

7 Belt and Chain Drives **07 Hours 16%**

7.1 Belt Drives: Classification of belt drives, Mathematical Relationship of belt tension, Flat belt selection for manufacturing catalogs, Pulleys for flat belt, V– Belt selection from catalogs, V–Grooved pulleys and Belt tension methods

7.2 Chain Drives: Introduction, Geometric relationship, Power rating of roller chains, Sprockets wheels and Design of chain drives.

8 Cylinders and Pressure Vessel **06 Hours 13%**

8.1 Introduction, Classification.

8.2 Design of thin cylinder and spherical shell subjected internal pressure.

8.3 Design of thick cylinder subjected to internal and external pressure.

8.4 Compound cylinder subjected internal and external pressure.

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi–media projector, black board, etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

On successful completion of the course, the student will be able to:

1. Understand the design methodology for machine elements.

2. Design various machine elements e.g. Power Screw, Shafts, Keys, Couplings, Brakes, Clutches, Belt and Chain Drives etc.
3. Design thin/thick/compound cylinders.
4. Assessing design data book and different codes of design.

F. **Recommended Study Material:**

Text Books:

1. Bhandari V. B., "Design of Machine Elements", Tata McGraw Hill Publishing Co.
2. PSG design data book

Reference Books:

1. Haideri Farazadak, " Machine Design ", Vol.– I, II, III, Nirali Prakashan – Pune.
2. Shigley Joseph Edward, "Machine Design", McGraw–Hill Professional Publishing.
3. Singh Sadhu, "Machine Design", Khanna Publishers, New Delhi
4. Sharma P. C. and Aggarwal D. K, "A Text Book of Machine Design: Mechanical Engineering Design", Katson Publication
5. Dieter George, "Engineering Design", McGraw–Hill Publishing, 4th Edition 2008.
6. Norton Robert L. "Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines", Tata McGraw Hill Publishing Co.
7. Sharma C. S. and Purohit Kamlesh, "Design of Machine Elements", Prentice–Hall of India Pvt. Ltd.– New Delhi
8. Patel R. C. and Pandya A. D., "Machine Design", Vol.–II, G. Jamnadasand Co.
9. Mott Robert L., "Machine Elements in Mechanical Design", Prentice Hall, 4th Edition.
10. Juvinall Robert C. and Marshek Kurt M., "Fundamentals of Machine Component Design", Wiley Publication.

Web material:

1. http://nptel.iitm.ac.in
2. Shariff Abdulla, "Hand Book of Properties of Engineering Materials and Materials and Design Data for Machine Elements".

Other material:

1. Engineering Failure Analysis, Science Direct Journal, ISSN: 1350–6307.
2. Journal of Materials and Design, ELSEVIER PUBLICATION.
3. IE Mechanical Engineering.
4. SADHNA (Engineering Science) (http://www.ias.ac.in/sadhna/)

ME – 348 PRODUCTION TECHNOLOGY

6^{th} Semester and 3^{rd} Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objectives of the Course:

- To introduce the students to the theory and mechanism of various cutting processes.
- To make students aware about design and utilization of mass production technologies.
- To introduce students with nontraditional manufacturing techniques for shaping newer materials.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Theory of Metal Cutting	12
2.	Analysis of Machine Tools	04
3.	Semi Automats and Automats	04
4.	Modern Machining Processes	15
5.	Gear and Thread manufacturing	03
6.	Jigs and Fixtures	07

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1 Theory of Metal Cutting **12 Hours 26%**

1.1 Cutting Tool Material, Types of cutting tools, Tool geometry and Force analysis.

1.2 Theory of metal cutting: Orthogonal and oblique cutting, Mechanics of chip formation and types of chips produced, Chip thickness ratio, Shear plane angle and its effect, Forces, Coefficient of friction, Shear strain, Power in machining.

1.3 Merchant circle diagram and its assumptions and use.

1.4 Chip breakers, Tool Dynamometers, Tool wears and methods of tool failure, Tool life.

1.5 Significance of temperature and sources of heat generation, Temperature measurement.

1.6 Cutting fluids and their properties, Economics of machining, Machinability and its evaluation.

2 Analysis of Machine Tools 04 Hours 09%

2.1 Working and auxiliary motions in machine tools. Design and analysis of machine tool elements like bed, structure, slide–ways and guide ways and spindle.

2.2 Selection of material, Static and dynamic stiffness, and dynamic rigidity. Drives in machine tools, Stepped regulation of speed and feed, A.P. and G.P. series.

3 Semi Automats and Automats 04 Hours 09%

3.1 Capstan and Turret lathes, Classification of automats, Specifications, Tooling Equipment, Bar stock feeding methods, Universal Chucking Equipment, Tool Layout for Turret,

3.2 Capstan And Automats, Single Spindle And Multi Spindle Automats, Bar Type And Chucking Type Machines Their Principles of Working Constructional Details and Tool Setting.

4 Modern Machining Processes 15 Hours 34%

4.1 Purpose, Need and Classification, Aspects considered in selection of a process.

4.2 Principle, construction, working, process parameters and their influence on machining, selection of parameters and product applications of the following processes: Ultrasonic machining, Abrasive jet machining, Water jet machining.

4.3 Chemical Machining, Electro Chemical Machining and Grinding, Electro discharge Machining, Plasma arc machining, Laser beam machining, Electron beam machining and Hot machining.

5 Gear and Thread Manufacturing 03 Hours 07%

5.1 Gear Manufacturing

5.2 Thread Manufacturing

6 Jigs and Fixtures 07 Hours 15 %

6.1 Usefulness and principles of jig–fixture design, Principles of location.

6.2 Types of locators, Types of clamping devices, Types of bushes, Selection of locators, Clamps and Bushes.

6.3 Types of jigs, Their relative merits, Demerits and Applications, Materials for various elements of jig–fixture, Design of milling, Turning and boring fixtures.

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi–media projector, black board, etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

On successful completion of the course, the student will be able to:

1. Understand the theory behind cutting of materials for shaping them into desired forms.
2. Analyze forces involved during machining process.
3. Understand motions in machine tools and analyze various elements of machine tools.
4. Outline tooling equipment of semi-automats and automats.
5. Interpret modern machining processes for material removal application.
6. Understand gear and thread manufacturing methods.
7. Understand work holding method for production activities.

F. Recommended Study Material:

Text Books:

1. Sharma P C, "A Text Book of Production Engineering", S. Chand Publishers, 11th Edition.
2. P. C. Pandey, "Production Engineering and Science", Standard Pub., 7th Edition, 2013.
3. HMT, "Production Technology", Tata McGraw Hill, 2001.

Reference Books:

1. Shaw M. C., "Metal Cutting Practices", Oxford University Press, 2nd Edition, 2010.

2. Ghosh A. and Mallik A., "Manufacturing Science", Affiliated East West Pub, 2nd Edition.
3. Mehta N. K., "Machine Tool Design and Numerical Control", Tata McGraw Hill Publ. Co. Ltd. 3rd Edition.
4. Pandey and Shan, "Modern Machining Processes", Tata McGraw Hill Publ. Co. Ltd, 2008.
5. Joshi P. H., "Jigs and Fixtures – Design Manual", Tata McGraw Hill Publ. Co. Ltd., 2nd Edition.
6. Fundamentals of Tool Design – American Society Of Tool Manufacturing, 4th Edition.
7. Donaldson C., "Tool Design", Tata McGraw Hill, 4th Edition.

Web Material:

1. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Manuf%20Proc%20II/New_index1.html

Other Material:

1. http://www.sciencedirect.com/science/journal/09240136
2. http://www.ieindia.org/publish/pr/pr.htm
3. http://www.ieindia.info/public.asp/me/me.htm
4. http://www.ias.ac.in/sadhana

ME – 349 SUMMER INTERNSHIP - I

5th Semester and 3rd Year

Credits and Hours:

Teaching Scheme	Project	Total	Credit
Hours/week	30	90	3
Marks	150	150	

A. Objectives of the Course:

Summer internships are required to be carried out in order to help students to find and know the applications of their theoretical knowledge, enhance their company/industry/organization experience, get familiar with the company/industry/organization culture and work ethics.

The main objectives for offering the internship for the students are:

- To get perspective and experience of the field
- To make them company/industry/organization ready
- To get familiar with modern tools and technologies
- To enhance technical writing skills in reporting as per the company/industry/organization standards
- To get involved in design, development and testing practices followed in the company/industry/organization
- To enhance their soft-skills, presentation skills, interpersonal skills, documentation skills and office etiquettes required to sustain in company/industry/organization environment
- To participate in teamwork and preferably as part of a multi-disciplinary team
- To understand the professional and ethical responsibilities of an engineer
- To make them more productive, consistent and punctual
- To make them aware about company/industry/organization best practices, processes and regulations

B. Instructional Method and Pedagogy:

- Summer internship shall be at least 90 hours during the summer vacation only.
- Department/Institute will help students to find an appropriate company/industry/organization for the summer internship.
- The student must fill up and get approved a Summer Internship Acceptance form by the company and provide it to the Coordinator of the department within the specified deadline.
- Students shall commence the internship after the approval of the department Coordinator. Summer internships in research center is also allowed.
- During the entire period of internship, the student shall obey the rules and regulations of the company/industry/organization and also those of the University.
- Due to inevitable reasons, if the student will not able to attend the internship for few days with the permission of the supervisor, the department Coordinator should be informed via e-mail and these days should be compensated later.
- The student shall submit two documents to the Coordinator for the evaluation of the summer internship:
    - Summer Internship Report
    - Summer Internship Assessment Form
- Upon the completion of summer internship, a hard copy of "Summer Internship Report" must be submitted to the Coordinator by the first day of the new term.
- The report must outline the experience and observations gained through practical internship, in accordance with the required content and the format described in this guideline. Each report will be evaluated by a faculty member of the department on a satisfactory/unsatisfactory basis at the beginning of the semester.
- If the evaluation of the report is unsatisfactory, it shall be returned to the student for revision and/or rewriting. If the revised report is still unsatisfactory the student shall be requested to repeat the summer internship.

C. Format of Summer Internship Report:

The report shall comply with the summer internship program principles. Main headings are to be centered and written in capital boldface letters. Sub-titles shall be written in small letters and boldface. The typeface shall be Times New Roman font with 12pt. All the margins shall be 2.5cm. The report shall be submitted in printed form and filed. An electronic copy of the report shall be recorded in a CD and enclosed in the report. Each report shall be bound in a simple wire vinyl file and contain the following sections:

- Cover Page
- Page of Approval and Grading
- Abstract page: An abstract gives the essence of the report (usually less than one page). Abstract is written after the report is completed. It must contain the purpose and scope of internship, the actual work done in the plant, and conclusions arrived at.
- TABLE OF CONTENTS (with the corresponding page numbers)
- LIST OF FIGURES AND TABLES (with the corresponding page numbers)
- DESCRIPTION OF THE COMPANY/INDUSTRY/ORGANISATION: Summarize the work type, administrative structure, number of employees (how many engineers, under which division, etc.), etc. Provide information regarding
    - Location and spread of the company
    - Number of employees, engineers, technicians, administrators in the company
    - Divisions of the company
    - Your group and division
    - Administrative tree (if available)
    - Main functions of the company
    - Customer profile and market share
- INTRODUCTION: In this section, give the purpose of the summer internship, reasons for choosing the location and company, and general information regarding the nature of work you carried out.
- PROBLEM STATEMENT: What is the problem you are solving, and what are the reasons and causes of this problem.
- SOLUTION: In this section, describe what you did and what you observed during the summer internship. It is very important that majority of what you write should be based on what you did and observed that truly belongs to the company/industry/organization.

- CONCLUSIONS: In the last section, summarize the summer internship activities. Present your observations, contributions and intellectual benefits. If this is your second summer internship, compare the first and second summer internships and your preferences.
- REFERENCES: List any source you have used in the document including books, articles and web sites in a consistent format.
- APPENDICES: If you have supplementary material (not appropriate for the main body of the report), you can place them here. These could be schematics, algorithms, drawings, etc. If the document is a datasheet and it can be easily accessed from the internet, then you can refer to it with the appropriate internet link and document number. In this manner you don't have to print it and waste tons of paper.

D. Students Learning Outcomes:

On successful completion of this course, the student will be able to:

1. To apply knowledge and skills learned in company/industry/organization to real-world problems
2. To solve engineering problems
3. To function in a team work
4. To work with teammates from other disciplines
5. To use experience related to professional and ethical issues in the work environment
6. To explain the impact of engineering solutions, developed in a project, in a global, economic, environmental, and societal context
7. To finds relevant sources (e.g., library, Internet, experts) and gather information
8. To demonstrates knowledge of contemporary issues related with engineering in general
9. To use new tools and technologies

HS-134A **CONTRIBUTOR PERSONALITY DEVELOPMENT**

6th Semester and 3rd Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	2		2	2
Marks	–	100	100	

G. Objectives of the Course:

To facilitate learners to:

- become familiar with basic concept of personality and personality development
- understand personality development theories and strategies
- evaluate one's personality and inculcate traits of an assertive personality
- develop an assertive personality
- develop life skills and required management traits
- enhance contributory personality for academic and career success

H. Outline of the Course:

Module No.	Title/Topic	Classroom Contact Sessions
1	**Concept of Personality:** • Meaning of Personality • Types of Personality • Factors contributing to Personality • Personality Traits	06
2	**Soft Skills and Personality Development:** • Critical, Creative and Positive Thinking • Leadership, Assertiveness and Negotiation Skills • Self-Management • People's Skills • Building Relationship Skills • Being a Team Player	08
3	**Developing Contributor Personality – Part I** • Concept of Contributor • Characteristics of a Contributor • The Contributor's Vision of Success & Career • The Scope of Contribution • Embarking on the Journey to Contributor-ship	06

4	**Developing Contributor Personality – Part II** • Focus on values • Engage deeply • Think in enlightened self-interest • Practice imaginative sympathy • Demonstrate trust behavior • Developing a sense of duty and morality	**06**
5	**Contemporary Issues in CPD** • Contemporary Practices & Trends in Contributor Personality Development • Case Study & Presentations	**04**
	Total	**30**

I. Pedagogy

The course is based on practical learning. Teaching will be facilitated by reading material, discussion, task-based learning, projects, assignments and various interpersonal activities like case studies, critical reading, group work, independent and collaborative research, presentations etc.

J. Evaluation

The students will be evaluated continuously in the form of internal as well as external evaluation. It is schemed as 30 marks for internal evaluation and 70 marks for external evaluation in the form of University examination.

Internal Evaluation

Students' performance in the course will be evaluatedon a continuous basis through the following components:

Sr. No.	Component	Number	Marks per incidence	Total Marks
3	Assignment / Project Work / Term Work / Quiz	5	5	25
4	Attendance and Class-room Participation			05
			Total	30

External Evaluation

The University Practical examination will be of 70 marks and will test the contributory personality aspects and their applications by carrying out practical assessment. The examination will avoid, as far as possible, evaluation on the basis of grammatical errors. Instead, it will focus on applications.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Practical / Viva	01	70	70
			Total	70

K. Learning Outcomes

After successfully passing through this course, the students will be able to –

1. Identify one's individual personality strengths and challenges
2. Develop more assertive and optimist attitude towards work and life
3. Develop quintessential soft skills to groom one's personality

L. Reference Books

- Contributor Personality Program Workbook (Volume 1,2),
- Contributor Personality Program ActivGuide, Illumine Knowledge Pvt. Ltd.

B. Tech. (Mechanical Engineering) Programme

SYLLABI
(Electives)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

ME 371: INTERNAL COMBUSTION ENGINES

5th Semester and 3rd Year

Program Elective - 1

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objectives of the Course:

- To study the working of SI and CI Engines and its components.
- To prepare and analyze valve timing diagrams and heat balance sheet.
- To understand and estimate the effects of variation in properties of air at various states.
- To carry out tests on I. C. Engines and calculate its efficiencies and performance parameters at various running conditions.
- To learn about the advanced technologies and research areas in engines.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction	02
2.	Fuel air cycles	06
3.	I.C. engine fuels & Fuel supply systems	10
4.	Ignition systems and governing	04
5.	Superchargers	04
6.	Combustion in IC engines	10
7.	Testing of I.C. Engine	06
8.	Pollution by I.C. Engines	03

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1.	**Introduction**	**02 Hours**	**4%**
1.1	Applications, actual working of IC engines, valve and port timing diagrams.		
2.	**Fuel air cycles**	**06 Hours**	**14%**
2.1	Reasons for variation of specific heats of gases change of internal energy and enthalpy during a process with variable specific heats, isentropic expansion with variable specific heats		
2.2	Effect of variable specific heats on air standard cycles of Otto and diesel cycles.		
2.3	Factors considered and assumptions made for fuel–air cycles, dissociation, comparison of air standard and fuel air cycles,		
2.4	Effect of operating variables on cycle analysis, difference between actual cycle and fuel air cycle for SI and CI engines.		
3.	**I.C. engine fuels & Fuel supply systems**	**10 Hours**	**22%**
3.1	Desirable properties of I.C. engine fuels, required qualities of S.I and C.I engine fuels,		
3.2	rating of S.I and C.I. engine fuels, HUCR, dopes/additives for S.I. and C.I. engines,		
3.3	use of alternate fuels like CNG, LNG, LPG, vegetable oils, biodiesel, alcohol, biogas and hydrogen for IC engines.		
3.4	Fuel supply system for SI engines, properties of air-petrol mixture, mixture requirement for different loads and speeds,		
3.5	simple carburetor and its working, calculation of air-fuel ratio, types of carburetors, limitations of a single jet carburetor,		
3.6	Modern carburetors, problems in carburetors, altitude compensation, gasoline injection in SI engines, mpfi system for modern automobile engines.		
3.7	Requirement of ideal injection system, types of injection systems, fuel pumps and injectors,		
3.8	Types of nozzles spray formation, quantity of fuel and size of nozzle orifice.		
4.	**Ignition systems and governing**	**04 Hours**	**9%**
4.1	Ignition system like battery, magneto, and electronic, spark plug, firing order.		
4.2	Governing system : quality, quantity and hit and miss governing,		
4.3	Intake and exhaust systems, Scavenging systems: scavenging processes and systems, scavenging pumps		
5.	**Superchargers**	**04 Hours**	**9%**

5.1 Types of superchargers. Supercharging of SI and CI engines,

5.2 effects of supercharging, supercharging limits, methods of supercharging, turbo charging

6. Combustion in I.C. Engines: 10 Hours 22%

6.1 Stages of combustion, ignition lag and the factors affecting the ignition lag, flame propagation and factors affecting flame propagation

6.2 Abnormal combustion and knocking in SI engines, factors affecting knocking, effects of knocking, control of knocking, combustion chambers for S.I. engines

6.3 Stages of combustion, delay period /ignition lag and the factors affecting it, detonation in C.I. engines,

6.4 Factors affecting detonation, controlling detonation, combustion chambers for C.I. engines.

7. Testing of I.C. Engine 06 Hours 13%

7.1 Aims of engine testing, measurement of indicated power, brake power, friction power, speed, air consumption, fuel consumption.

7.2 IC engine efficiencies, specific output, specific fuel consumption, heat balance sheet,

7.3 Performance characteristics of SI and CI engines, testing of IC engines as per Indian standard 10001.

8. Pollution by I.C. Engines 03 Hours 7%

8.1 Emission of pollutants from SI and CI engines, control of emissions from SI and CI engines, measurement of pollutants in exhaust gases,

8.2 Effect of different pollutants on human and plant life, emission (Euro and Bharat stage) norms.

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. **Students Learning Outcomes:**

On successful completion of the course, the student will be able to:

1. Understand the actual working of various components of IC engine and understand the processes.
2. Make calculations on performance of engine.
3. Express the effect of various operating variables on engine performance.
4. Distinguish normal and abnormal combustion phenomena in SI and CI engines.
5. Justify the suitability of conventional and non-conventional fuels for IC engines.
6. Aware about recent trends and research areas in I.C. engines.

F. **Recommended Study Material:**

Text Books:

1. Domkundwar V. M., "A course in internal combustion engines", Dhanpatrai and Co. (p) ltd, New Delhi.
2. Mathur and Sharma, "Internal combustion engines", Dhanpatrai and sons, New Delhi.
3. Ganeshan V, "Internal combustion engines", Tata Mc Grawhill pub.co. ltd., New Delhi.

Reference Books:

1. Ramalingam, "Internal combustion engines", Scitech Pub. India Pvt. Ltd., Chennai
2. Gupta H N, "Internal combustion engines", PHI Learning, New Delhi.

Web Materials:

1. http://nptel.iitm.ac.in
2. saeeng.saejournals.org/content/

ME – 373 METAL CASTING TECHNOLOGY

5th Semester and 3rd Year

Program Elective - 1

Credit Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- To provide a knowledge of metal casting in perspective of its science, engineering and technology.
- To train the students about tooling and methoding design in metal casting.
- To provide background for computer aided casting design and analysis.
- To aware the students about various foundry practices adapted in industries.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction to Metal Casting Technology	02
2.	Metal Casting Science	09
3.	Pattern, Mould and Core Design (Tooling)	06
4.	Feeder and Gating Design (Methoding)	10
5.	Cost Estimation in Casting	04
6.	Design for Castability	04
7.	Advances in Casting Processes	05
8.	Foundry Practices	05

Total hours (Theory): 45

Total hours (Lab): 30

Total: 75

C. Detailed Syllabus:

1 Introduction to Metal Casting Technology **02 hours** **4%**

1.1 Foundry Challenges, Foundry Pressures, Foundry Clusters

1.2 Customers' Requirements , Defining Perfect Castings, Casting Conformance

2	**Metal Casting Science**	**09 hours**	**20%**
2.1	Basic physics involved in metal casting process, Metal flow phenomenon: Pressure, velocity and losses, Turbulence and Fluidity		
2.2	Solidification phenomena: Liquid solid transformation, nucleation, crystal growth		
2.3	Progressive and directional solidification, Analytical solutions of solidification heat transfer, Microstructure and cooling stresses		
3	**Pattern, Mould and Core Design (Tooling)**	**06 hours**	**14%**
3.1	Orientation and Parting, Mould Parting Analysis, Pattern Design		
3.2	Cored hole features, Shape Complexity, Core Print Design and Analysis		
3.3	Mould cavity layout		
4	**Feeder and Gating Design Analysis (Methoding)**	**10 hours**	**22%**
4.1	Feeder location and shape, Feeder and Neck design, Methods to achieve directional solidification (Feed aid design)		
4.2	Gating system and types, Gating channel layout, Optimal filling time, Gating element design		
4.3	Computer aided analysis of casting process		
5	**Cost Estimation in Metal Casting**	**04 hours**	**9%**
5.1	Casting process selection, Tooling cost estimation, Material cost estimation, Conversion cost estimation		
6	**Design for Castability**	**04 hours**	**9%**
6.1	Product design for castability, Process friendly design, Castability analysis, Collaborative engineering		
7	**Advances in Casting Processes**	**05 hours**	**11%**
7.1	Near net shape process: Investment Casting & Lost foam casting, VAEPC, Squeeze casting, Thixocasting and Rheocasting, Anitoch plaster mould casting, Slush Casting, Stir casting, Rapid tooling in casting		
8	**Foundry Practices**	**05 hours**	**11%**
8.1	Melting and casting of ferrous and nonferrous alloys, Foundry mechanization, Dust problems in foundry, Foundry environment, health and safety		

D. Instructional Methods and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi–media projector, black board, etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Student Learning Outcomes / objectives:

On successful completion of the course, the student will be able to:

1. Understand the basic concepts of metal casting such as metal flow and solidification phenomena.
2. Design pattern, mould and core (Tooling design).
3. Evaluate and design casting feeding and gating system.
4. Propose solutions to achieve desired quality and yield.
5. Estimate the costs involved in various stages of metal casting.
6. Evaluate cast components in terms of its castability.
7. Understand about advances in casting processes.
8. Understand melting and casting practices of ferrous and non ferrous alloys.

F. Recommended Study Material:

Text Books:

1. Ravi B., "Metal Casting Computer Aided Design and Analysis", PHI Learning Pvt. Ltd.
2. Campbell J., "Castings", 2nd edn, Butterworth-Heinemann, Oxford.

Reference books:

1. Campbell J., "Casting practice: the 10 rules of casting," Elsevier Butterworth-Heinemann, Oxford
2. Khanna O. P., "Foundry Technology", Dhanpat Rai Publications
3. Stefanescu D. M., "Science and engineering of casting solidification," 2nd edn, Springer,

New YorkBeeley P. R., “Foundry Technology”, Butterworth

4. Webster, P. D., “Fundamentals of Foundry Technology”
5. Mukherjee, P. C, “Fundamentals of Metal casting Technology”
6. Bralla J. G., “Design for manufacturability,” 2nd edn, McGraw-Hill, New York

Web materials:

1. http://efoundry.iitb.ac.in/Academy/index.jsp
2. http://nptel.iitm.ac.in/courses.php?branch=Mechanical

Other materials

1. Indian Foundry Journal
2. International Journal of Metal Casting (AFS-American Foundry Society)
3. AFS Transactions

ME – 376.01 **INSTRUMENTATION AND CONTROL**

5th Semester and 3rd Year

Program Elective - 1

Credit Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. **Objective of the Course:**

- To provide a basic knowledge about measurement systems
- To learn about Signal conditioning and Data acquisition components
- To learn about various sensors used for measurement of physical quantities
- To integrate the measurement systems with the process for process monitoring and control

B. **Outline of the Course:**

Sr. No	Title of the Unit	No of Hours
1	Introduction to Mechatronics, Signal conditioning and Data acquisition	08
2	Sensors and transducers	08
3	Industrial Measurements	10
4	Microprocessor and Micro controller	12
5	Programmable Logic Controller	07

Total hours (Theory): 45

Total hours (Lab): 30

Total: 75

C. **Detailed Syllabus:**

1 **Introduction to Mechatronics, Signal conditioning and Data acquisition** 08 hours 18%

1.1 Objectives of Metrology Classification of Measurements and Instruments, Standards of Measurement; Elements of Measuring System; Range and span, accuracy and precision, calibration, hysteresis and dead zone, sensitivity and linearity, threshold and resolution

1.2 **Introduction to signal conditioning** and its necessity , functions of signal conditioning equipment, amplification of signals , types of amplifiers, filters, **Introduction to Data Acquisition system**, analog to digital conversion, digital to analog conversion

1.3 **Introduction to Industry 4.0** Industrial revolution, beginning of industry 4.0, Key components of industry 4.0, Application of industry 4.0

2 Sensors and transducers 08 hours 18%

2.1 **Introduction:** Sensor classification, Sensor characteristics: Transfer function, calibration, hysteresis, non-linearity, repeatability, resolution, dynamic impedance, excitation, dynamic characteristics, reliability, etc.

2.2 **Physical Principles of Sensing:** Electric charges, fields and potentials; Capacitance; Magnetism; Induction; Resistance; Piezoelectric effect; pyroelectric effect; Hall effects; Seeback and Peltier effects; Sound waves; Temperature and thermal properties of materials; Heat transfer; Light

3 Industrial Measurements 10 hours 22%

3.1 **Sensors for displacement** (Potentiometers, Differential transformers, capacitive sensor, Eddy current sensor), Measurement of Acceleration

3.2 **Speed Measurement**: Introduction, Mechanical tachometers: Revolution counter, Centrifugal force tachometer, Resonance tachometer Electric tachometers: Eddy current type tachometers, Electric Generator type tachometers, Contactless type tachometers, Frequency type tachometers, Ignition type tachometers, Stroboscopic tachometers, Pneumatic type speed transmitting elements, Measurement of Speed, Frequency and Short Time Intervals by direct application of frequency standards by comparative methods.

4 Microprocessor and Micro controller 12 hours 27%

4.1 Introduction to analog and digital computers, Difference between an analog and digital computer, Computer peripherals

4.2 Introduction to Microprocessor, Types of microprocessor, Microprocessor system , Features 8085 Microprocessor, Microprocessor programming , Digital logic , Organization of Microcomputers, Types of microcontrollers, introduction of Microcontrollers, Features of 8051 microcontroller and its architecture, comparison between microprocessor and microcontroller

4.3 **Arduino:** Introduction to Arduino, Architecture of Arduino board, Programming in Arduino bard, Integration of different sensors with Arduino board

5	**Programmable Logic Controller**	**07 hours**	**15%**
5.1	Introduction to Programmable Logic Controllers (PLCs), history of PLCs, Advantages of PLCs and Comparison of PLC based control systems with other conventional control systems.		
5.2	Block diagram of PLC, Internal architecture of PLC, Digital and Analog Input output modules of PLCs, scan cycle and scan time, connections and wiring of various Inputs and Outputs of Plants with the PLC.		

D. Instructional Methods and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi–media projector, black board, etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Student Learning Outcomes / objectives:

On successful completion of the course, the student will be able to:

1. Understand basic knowledge about mechatronic with data acquisition and Signal conditioning.
2. Recognize the various sensors used for measurement of typical physical quantities.
3. Understand about basic concepts of microprocessor and microcontroller.
4. Demonstrate the integration of different sensors with Arduino board in real time applications.

F. Recommended Study Material:

Text Books:

1. Dunn C. William, "Fundamentals of Industrial Instrumentation and Process Control", McGraw-Hill.
2. Rajput R.K., "Mechanical Measurements and Instrumentation", S. K. Kataria and Sons
3. Rajput R.K., "Mechatronics ", S. Chand Publishing, 2016
4. Jain R. K., "Engineering Metrology", Khanna Publisher, 2009

   Bryan A. L and Bryan A. E.," Programmable Controllers: Theory-and-Implementation" An Industria Text Company Publication, 1997

Reference books:

1. Venkateshan S. P., “Mechanical Measurements”, Ane Books India, (2008).
2. Kumar D.S., “Mechanical Measurements and Control”, Metropolitan, New Delhi, 4th Edition
3. W. Bolton, “ Instrumentation and control systems” , 2nd edition, Newnes, 2000
5. Bewoor, Vinaykulkarni, “Metrology and Measurement”, Tata McGraw Hill, 1st Edition (2009).
6. Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York, 1999.

Other materials

1. https://nptel.ac.in/courses/112103174/3
2. https://nptel.ac.in/courses/106105166/
3. https://nptel.ac.in/courses/112102011/11

ME – 372.01 FINITE ELEMENT METHODS

6^{th} Semester and 3^{rd} Year

Program Elective - II

Credits and Hours:

Teaching Scheme	**Theory**	**Practical**	**Total**	**Credit**
Hours/week	3	0	3	3
Marks	100	00	100	

A. Objectives of the Course:

- To understand the need in design for the finite element method.
- To tie understanding of mechanical engineering design concepts to use the finite element analysis software correctly and efficiently.

B. Outline of the Course:

Sr. No.	**Title of the Unit**	**Minimum number of hours**
1.	Fundamental Concepts	06
2.	One-Dimensional Problems	13
3.	Two-Dimensional Problems	13
4.	Finite Element Analysis in different Engineering applications	13

Total Hours (Theory): 45

Total Hours: 45

C. Detailed Syllabus:

1. Fundamental Concepts **06 Hours 13%**

1.1 Introduction; Historical Background, Stresses and Equilibrium, Boundary Conditions.

1.2 Strain-displacement Relations, Stress- strain Relations, Temperature Effects.

1.3 Potential Energy and Equilibrium; The Rayleigh-Ritz Method, Galerkin's method.

2	**One-Dimensional Problems**	**13 Hours**	**29%**
2.1	Introduction; Finite Element Modeling, Coordinates and a Shape Functions.		
2.2	The Potential Energy Approach; The Galerkin Approach, Assembly of the Global Stiffness Matrix and Load Vector. Properties of Stiffness Matrix.		
2.3	The Finite Element Equations; Treatment of Boundary Conditions, Quadratic Shape Functions; Temperature effects.		
3	**Two-Dimensional Problems**	**13 Hours**	**29%**
3.1	Problem formulation for 2D Problems		
3.2	Finite Element Modeling for Axis Symmetric Problems Formulation		
4	**Finite Element Analysis in different Engineering applications**	**13 Hours**	**29%**
4.1	Heat Transfer , Fluid flow, vibration etc		

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi–media projector, black board, etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- In the lectures discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

At the completion of the course, students will be able to

1. Understand the concept of finite element method for solving Mechanical Engineering problems.
2. Apply the knowledge of FEM for 1D stress analysis, heat transfer analysis and flow analysis.
3. Formulate and solve problems of trusses, beams, planar loading and axisymmetric.
4. Formulate and solve preliminary problems for dynamic analysis.
5. Interpretate and evaluate the quality of results obtained using FE software.

F. Recommended Study Material:

Text Books:

1. Chandrupatla and Belagundu, "Finite Elements in Engineering", Prentice Hall of India Private Ltd., 1997.
2. Rao S.S., "Finite Element Method in Engineering", Elsevier Pergaman Press, 1997.

Reference Books:

1. Seshu, P., Textbook of Finite Element Analysis, Prentice-Hall, India, 2003
2. George R. Buchaman, "Schaum's Outline of Finite Element Analysis", McGraw Hill Company, 1994.
3. Reddy J.N., "An Introduction to the Finite Element Method", McGraw Hill, Int. Edition, 2005.
4. Cook Robert Davis, "Concepts and Applications of Finite Element Analysis", John Wiley and Sons, 1999.
5. David V. Huton ,"Fundamentals Of Finite Element Analysis" Tata McGraw Hill,Edition 2005.

Web Materials:

1. http://www.mece.ualberta.ca/Tutorials/ansys/
2. http://www.ansys.com
3. http://www.owlnet.rice.edu/-mech403/FEA

Other Material:

1. Software: ANSYS
2. Finite Elements in Analysis and Design, an International Journal for Innovations in Computational Methodology and Application, ELSEVIER Publication.

ME 374: AUTOMOBILE ENGINEERING

6th Semester and 3rd Year

Program Elective -II

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	0	3	3
Marks	100	00	100	

A. Objectives of the Course:

- To make students understand the basic concepts, requirements and working of various components of automobile.
- To enable students to design basic systems like brakes, steering, and suspensions.
- To aware students about recent technologies in automobile engineering and its working.
- To reduce the pace between basic vehicle technology and technologies in modern vehicles.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction to Automobile & Automobile Performance	02
2.	Chassis, Frame & Body	04
3.	Transmission System	10
4.	Propeller Shaft, Differential & Final Drive	07
5.	Axle, Suspension, Steering and Brakes System	12
6.	Wheels & Tyres	04
7.	Battery, Lighting System, Accessories and Safety	04
8.	Regulation and Standardization of Vehicles	02

Total Hours (Theory): 45

Total Hours: 45

C. Detailed Syllabus:

1	**Introduction to Automobile & Automobile Performance**	**02Hours**	**4%**
1.1	Development of automobile, classification of automobiles, main parts of automobiles, vehicle assemblies, specifying an automobile		
1.2	resistance to the motion of the vehicle, power required for propulsion of the vehicle, power required for acceleration		
1.3	effect of different drives like front wheel/rear wheel/for wheel drive, stability of a vehicle on a slope, dynamics of a vehicle running on banked track, stability of a vehicle taking a turn		
2	**Chassis, Frame & Body**	**04Hours**	**9%**
2.1	Types of frames, engine location, Comparison of front and rear mounting of engine, arrangement of clutch assembly, gearbox, and propeller shaft with universal joints		
2.1	Front and rear differentials, rear, front and four wheel drives, their relative merits		
2.2	Types of chassis, pre requirements of body, types of bodies & their construction, aerodynamic considerations in body profiling, agronomical considerations, defects in frames and body		
3	**Transmission System**	**10Hours**	**23%**
3.1	Necessity of a clutch, requirements of a good clutch, used in automobiles		
3.2	Constructional features and working of different types of clutch (like single plate/multi plate/cone/ semi centrifugal/ fully centrifugal/wet etc.)		
3.3	calculation of surface area and number of driving and driven plates,		
3.4	Nature of wear and tear each components, effect of misalignment and mis- adjustment of components, fluid coupling, trouble shooting in clutch systems		
3.5	Functions of gearbox, need of gear box, gears & gear ratios, principle of gearing,		
3.6	Types of gear boxes, manual gearboxes, sliding mesh/ constant mesh/ synchromesh type gear box, transfer case of 4 wheel drive vehicle		
3.7	Basic devices used in automatic transmission, principle of epicyclic gearing, torque converter, free wheel clutch, over speed drive and its working.		
3.8	Semi/fully automatic transmission, continuously variable transmission (CVT)		
4	**Propeller Shaft, Differential & Final Drive**	**07Hours**	**15%**
4.1	Propeller shafts and their types, fluid drive and fluid flywheel, universal joints, Hotchkiss drive, torque tube drive, whirling of propeller shaft		
4.2	Principle of the differential, locking differential, limited slip differential		

4.3 Final drives and its types, hypoid type final drive

5 Axle, Suspension, Steering and Brake System **12 Hours 27%**

5.1 Front Axle: Types, construction, components and their functions, Rear axle, rear axle drives, rear axle shaft supporting, rear axle casing, axle breather, oil retention

5.2 Suspension System: Principle, type of suspension system, conventional and independent front and rear axle, spring, rubber and air suspensions, automatic/hydro suspension system, shock absorbers

5.3 Steering System: Steering layout, types of steering gears, steering linkages, steering mechanism, definitions and significance of camber, caster, king pin inclination, toe in and toe out on turn, measurement and adjustment of various steering system layouts, steering ratio, under steering and over steering, power assisted steering, steering geometry, checking wheel alignment and steering geometry, computerized wheel alignment equipment, steering trouble shooting

5.4 Principle, braking distance, braking efficiency ,weight transfer, wheel skidding,

5.5 Principle and working of various types of brakes (like drum /disc /mechanical / girling mechanical/hydraulic etc.),

5.6 Power assisted brakes, hand brake, anti-lock brake systems (ABS), diagnosis of faults

6 Wheels & Tyres **04Hours 9%**

6.1 Types of wheels, wheel dimensions, types of tyres

6.2 comparison of radial and bias ply tyres, tyre materials, indicators,

6.3 Nitrogen in tyres, factors affecting tyre life, wheel and tyre trouble shooting.

7 Battery, Lighting System , Accessories and Safety System **04Hours 9%**

7.1 Battery: Construction, working, methods of rating, faults, charging methods, test, generator and cranking motor with drive purpose, construction, faults and diagnosis, voltage and current regulator, purpose, typical circuit, layout, working principle, voltage setting.

7.2 Lighting system: Wiring system, head lights, aiming of head lights, indicating lights.

7.3 Accessories and Safety System: Accessories like direction indicators, hazard flashes, horn, speedometer, tachometer, wind screen wiper, wind screen washer, central locking system, power windows, and vehicle tracking system Safety provisions like air bags/ safety belts

8 **Regulation and Standardization of Vehicles** **02Hours 4%**

8.1 Motor vehicle act, registration of motor vehicles, driving license, control of traffic, insurance against third party, claims for compensation, traffic signs, central motor vehicle rules, vehicle safety standards and regulations, classification and definition of vehicles, enforcement of emission norms, duties of surveyor.

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- In the lectures discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

On successful completion of the course, the student will be able to:

- Understand needs and working of various systems in automobiles.
- Calculate and design various systems commonly used in automobiles.
- Develop a skill to work in multi-disciplinary streams.
- Aware with the maintenance and repair of automobiles.
- Understand market and businesses of automobile industry.
- Aware with recent trends and research areas in Automobiles.

F. Recommended Study Material:

Text Books:

1. Singh Kirpal, "Automobile Engineering" Volume I & II, Standard Pub.& Dist.
2. Gupta K. M. "Automobile Engineering" Volume I & II, Umesh Pub.
3. Gupta R. B. "Automobile Engineering", Satya Prakashan.
4. Giri N. K., "Automobile Technology", Khanna Pub.

Reference Books:

1. Crouse W., "Automotive Mechanics", Tata Mc Graw Hill.
2. Narang G. B. S. "Automobile Engineering", Khanna Pub.

Web Material:

1. http://nptel.iitm.ac.in
2. http://www.sae.org/pubs/automotive/
3. www.ijat.net/

Other Material:

1. International Journal of Automotive Technology (www.ijat.net/)
2. International Journal of Automotive Technology

ME – 375 ADVANCED MATERIALS

6th Semester and 3rd Year

Program Elective-II

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	0	3	3
Marks	100	00	100	

A. Objectives of the Course:

- To help students to learn and identify the structure of materials, type of bonding and defects in a compound.
- To make students understand the various aspects regarding the different types of composite materials, their properties and applications.
- Introduce students to the concepts of modern composite materials; and equip them with knowledge on how to fabricate and carry out standard mechanical test on composites.
- To increase knowledge of students about various types and properties of advanced alloys.
- To familiarize students concerning the latest developments occurring in variety of functional nanomaterials.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Structure of Materials	14
2.	Composites Materials	09
3.	Advanced Alloys	14
4.	Functional Nano Materials	08

Total Hours (Theory): 45

Total Hours (Lab): 00

Total Hours: 45

C. **Detailed Syllabus:**

1	**Structure of Materials**	**14 Hours**	**30%**
1.1	The Four Electron Quantum Numbers, Nomenclature for the Electronic States, Bonding and Energy Levels, Types of Bonds.		
1.2	Structure of Metals and Alloys, Crystal Structures and Systems, Interplanar Spacings, Types of Defects, Dislocations.		
1.3	Structure of Ceramics and Glasses, Pauling's Rules, Ceramic Crystal Structures, The Structure of Glasses.		
2	**Composites Materials**	**09 Hours**	**20%**
2.1	Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites(MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fiber reinforced composites. Fabrication methods of composite materials. Applications of various types of composites.		
3	**Advanced Alloys**	**14 Hours**	**30%**
3.1	Alloy steels, Maraging steels, High-strength low-alloy (HSLA) steels, Dual-phase (DP) steels, Mechanically alloyed (MA) steels.		
3.2	Superalloys, Basic alloying features, Nickel-based superalloy, Dispersion-hardened superalloys.		
3.3	Titanium alloys, Basic alloying and heat-treatment features, types of titanium alloys, Structural intermetallic compounds, General properties of intermetallic compounds, Nickel aluminides,		
3.4	Titanium aluminides, Other intermetallic compounds, Aluminum-lithium alloys,		
4	**Functional Nano Materials**	**8 Hours**	**20%**
4.1	Materials for nanotechnology, Introduction, Nanoparticles, Fullerenes and nanotubes, Quantum wells, wires and dots, Bulk nanostructured solids, Mechanical properties of small material volumes.		

D. **Instructional Method and Pedagogy:**

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi–media projector, black board, etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as

a part of continuous internal theory evaluation.

- In the lectures discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

On successful completion of this course, the student will be able to:

1. Understand the structure of advanced materials.
2. Identify and explain the types of composite materials and their characteristic features.
3. Understand and explain the methods employed in composite fabrication
4. Know about advanced alloys and its applications.
5. Understand the potential in functional Nano materials for engineering applications.
6. Apply advanced engineering materials for given case studies.

F. Recommended Study Material:

Text Books:

1. Raghavan V., "Materials Science and Engineering", Prentice-Hall of India Private Limited 2003.
2. Smith W. F., "Principles of Materials Science and Engineering", McGraw Hill, New York 1994.
3. Reid Hill R. E., "Physical Metallurgy Principles"- PWS-Kent Publishing 2004.
4. Callister W. D., "An Introduction Materials Science & Engineering", John Wiley & Sons 2007.
5. Mathews F.L. and Rawlings R.D., Composite materials: Engineering and Science, Chapman and Hall, London, England, 1st edition, 1994.
6. Chawla K.K., Composite materials, Sringer Verlag, 1987.

Reference Books:

1. Van Vlack L.H., "Elements of Materials Science and Engineering", Addison Wisley, New York.
2. Smallman R. E. and Ngan A. H.W., "Physical Metallurgy and Advanced Materials", Elsevier, UK
3. Mitchell B. S., "An introduction to Materials Engineering and Science", John Wiley & Sons, New Jersey, 2004

Other Materials:

1. Journal of Material Science and Technology.
2. Journal of Material Chemistry.
3. Advanced Materials Journal.
4. Nanotechnology Journal.
5. Advanced Functional Materials Journal.

Faculty of Technology & Engineering

ACADEMIC REGULATIONS
&
SYLLABUS

(Choice Based Credit System)

Bachelor of Technology Programme

(Fourth Year Mechanical Engineering)

Education Campus – Changa, (ECC), hitherto a conglomerate of institutes of professional education in Engineering, Pharmacy, Computer Applications, Management, Applied Sciences, Physiotherapy and Nursing, is one of the choicest destinations by students. It has been transformed into Charotar University of Science and Technology (CHARUSAT) through an Act by Government of Gujarat. CHARUSAT is permitted to grant degrees under Section-22 of UGC-Govt. of India.

The journey of CHARUSAT started in the year 2000, with only 240 Students, 4 Programmes, one Institute and an investment of about Rs. 3 Crores (INR 30 million). At present there are seven different institutes falling under ambit of six different faculties. The programmes offered by these faculties range from undergraduate (UG) to Ph.D degrees including M.Phil. These faculties, in all offer 23 different programmes. A quick glimpse in as under:

Faculty	Institute	Programmes Offered
Faculty of Technology & Engineering	Chandubhai S. Patel Institute of Technology	B. Tech M. Tech Ph. D
	Devang Patel Institute of Advance Technology and Research	B.Tech CE CSE IT
Faculty of Pharmacy	Ramanbhai Patel College of Pharmacy	B. Pharm M. Pharm Ph. D PGDCT/ PGDPT
Faculty of Management Studies	Indukaka Ipcowala Institute of Management	M.B.A PGDM Ph.D Dual Degree BBA+MBA
Faculty of Applied Sciences	P.D.Patel Institute of Applied Sciences	M.Sc M.Phil Ph.D Dual Degree

Faculty	Institute	Programmes Offered
		B.Sc+M.Sc
Faculty of Computer Applications	Smt. Chandaben Mohanbhai Patel Institute of Computer Applications	M.C.A/MCA (Lateral) M.Sc IT Ph. D Dual Degree BCA+MCA
Faculty of Medical Sciences	Ashok and Rita Institute of Physiotherapy	B.PT M.PT Ph.D
	Manikaka Topawala Institute of Nursing	B.Sc M.Sc GNM
	Charotar Institute of Paramedical Sciences	Ph.D PGDHA

The development and growth of the institutes have already led to an investment of over Rs.63 Crores (INR 630 Million). The future outlay is planned with an estimate of Rs. 250 Crores (INR 2500 Million).

The University is characterized by state-of-the-art infrastructural facilities, innovative teaching methods and highly learned faculty members. The University Campus sprawls over 100 acres of land and is Wi-Fi enabled. It is also recognized as the Greenest Campus of Gujarat.

CHARUSAT is privileged to have 350 core faculty members, educated and trained in Stanford, IITs, IIMs and leading Indian Universities, and with long exposure to industry. It is also proud of its past students who are employed in prestigious national and multinational corporations.

From one college to the level of a forward-looking University, CHARUSAT has the vision of entering the club of premier Universities initially in the country and then globally. High Moral Values like Honesty, Integrity and Transparency which has been the foundation of ECC continues to anchor the functioning of CHARUSAT. Banking on the world class infrastructure and highly qualified and competent faculty, the University is expected to be catapulted into top 20 Universities in the coming five years. In order to align with the global requirements, the University has collaborated with internationally reputed organizations like Pennsylvania State

University – USA, University at Alabama at Birmingham – USA, Northwick Park Institute –UK, ISRO, BARC, etc.

- ☞ Participatory and interactive discussion-based classes.
- ☞ Sessions by visiting faculty members drawn from leading academic institutions and industry.
- ☞ Regular weekly seminars.
- ☞ Distinguished lecture series.
- ☞ Practical, field-based projects and assignments.
- ☞ Summer training in leading organizations under faculty supervision in relevant programmes.
- ☞ Industrial tours and visits.
- ☞ Extensive use of technology for learning.
- ☞ Final Placement through campus interviews.

Exploration in the field of knowledge through research and development and comprehensive industrial linkages will be a hallmark of the University, which will mould the students for global assignments through technology-based knowledge and critical skills.

The evaluation of the student is based on grading system. A student has to pursue his/her programme with diligence for scoring a good Cumulative Grade Point Average (CGPA) and for succeeding in the chosen profession and life.

👍 CHARUSAT welcomes you for a Bright Future 👍

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

Faculty of Technology and Engineering

ACADEMIC REGULATIONS

Bachelor of Technology (Mechanical Engineering) Programme

(Choice Based Credit System)

Charotar University of Science and Technology (CHARUSAT)

CHARUSAT Campus, At Post: Changa – 388421, Taluka: Petlad, District: Anand

Phone: 02697-247500, Fax: 02697-247100, Email: info@charusat.ac.in

www.charusat.ac.in

FACULTY OF TECHNOLOGY AND ENGINEERING

ACADEMIC REGULATIONS

Bachelor of Technology Programmes

Choice Based Credit System

To ensure uniform system of education, duration of undergraduate and post graduate programmes, eligibility criteria for and mode of admission, credit load requirement and its distribution between course and system of examination and other related aspects, following academic rules and regulations are recommended.

1) System of Education

Choice based Credit System with Semester pattern of education shall be followed across The Charotar University of Science and Technology (CHARUSAT) both at Undergraduate and Postgraduate levels. Each semester will have at least 90 working days duration. Every enrolled student will be required to take a course works in the chosen subject of specialization and also complete a project/dissertation if any. Apart from the Programme Core courses, provision for choosing University level electives and Programme/Institutional level electives are available under the Choice based credit system.

2) Duration of Programme

i)	**Undergraduate programme**	**(B.Tech)**
	Minimum	8 semesters (4 academic years)
	Maximum	16 semesters (8 academic years)

3) Eligibility for admissions

As enacted by Govt. of Gujarat from time to time.

4) Mode of admissions

As enacted by Govt. of Gujarat from time to time.

5) Programme structure and Credits

As per annexure – 1 attached

6) Attendance

6.1 All activities prescribed under these regulations and listed by the course faculty members in their respective course outlines are compulsory for all students pursuing the courses. No exemption will be given to any student from attendance except on account of serious personal illness or accident or family calamity that may genuinely prevent a student from attending a particular session or a few sessions. However, such unexpected absence from classes and other activities will be required to be condoned by the Dean/Principal.

6.2 Student attendance in a course should be 80%.

7) Course Evaluation

7.1 The performance of every student in each course will be evaluated as follows:

7.1.1 Internal evaluation by the course faculty member(s) based on continuous assessment. The continuous assessment will be conducted by the respective department/ institute.

7.1.2 Final end-semester examination by the University through written paper or practical test or oral test or presentation by the student or combination of these.

7.1.3 The weightages of continuous assessment and end-semester University examination in overall assessment shall depend on individual course as approved by Academic Council through Board of Studies.

7.1.4 The performance of candidate in continuous assessment and end-semester examination together (if applicable) shall be considered for deciding the final grade in a course.

7.1.5 In order to earn the credit in a course a student has to obtain grade other than FF.

7.2 Performance in continuous assessment and end-semester University Examinations

7.2.1 Minimum performance with respect to continuous assessment as well as end-semester university examination will be an important consideration for passing a course. Details of minimum percentage of marks to be obtained in the examinations are as follows:

Minimum percentage marks to be obtained in end-semester University examination (for applicable courses)	Minimum overall percentage marks to be obtained in each course
40%	45%

7.2.2 If a candidate obtains minimum required percentage of marks in end-semester University examination in an applicable course but fails to obtain minimum required overall percentage of marks, he/she has to repeat the examination till the minimum required overall percentage of marks are obtained.

8) Grade Point System

8. 1. The total of the internal evaluation marks and final University examination marks in each course will be converted to a letter grade on a ten-point scale as per the following scheme:

Table 1: Grading Point System (UG)

Range of Marks (%)	≥80	**≥73 <80**	**≥66 <73**	**≥60 <66**	**≥55 <60**	**≥50 <55**	**≥45 <50**	**<45**
Grade	AA	AB	BB	BC	CC	CD	DD	FF
Grade Point	10	09	08	07	06	05	04	00

8. 2. The student's performance in any semester will be assessed by the Semester Grade Point Average (SGPA). Similarly, his performance at the end of two or more consecutive semesters will be denoted by the Cumulative Grade Point Average (CGPA). The SGPA and CGPA are calculated as follows:

(i) SGPA = $\Sigma C_i G_i / \Sigma C_i$ where C_i is the number of credits of course i

G_i is the Grade Point for the course i
and i = 1 to n, n = number of courses in the semester

(ii) CGPA = $\Sigma C_i G_i / \Sigma C_i$ where C_i is the number of credits of course i
G_i is the Grade Point for the course i
and i = 1 to n, n = number of courses of all semesters up to which CGPA is computed.

9) Award of Class

- The class awarded to a student in the programme is decided by the final CGPA as per the following scheme:

Award of Class	CGPA Range
First Class with Distinction	CGPA ≥ 7.50
First class	7.50 > CGPA ≥ 6.00
Second Class	6.00 > CGPA ≥ 5.00
Pass Class	5.00 > CGPA ≥ 4.50

Grade sheets of only the final semester shall indicate the class. In case of all the other semesters, it will simply indicate as Pass / Fail.

9. 1. Maximum duration allowed for Completion of a programme

- Maximum duration to allow for completion of a particular programme shall not be more than twice the normal duration of the respective programme. For example, a 6-Semester programme should be completed within not more than 12 semesters.

10) Detention Criteria

- No student will be allowed to move further in next semester if CGPA is less than 3 at the end of an academic year.
- A Student will not be allowed to move to third year if he/she has not cleared all the courses of first year.
- A student will not be allowed to move to fourth year if he/she has not cleared all the courses of first and second year.

11) Transcript

- A transcript issued to the student at the time of leaving the university will contain a consolidated record of all the courses taken by him / her, grades obtained and the final CGPA.

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

(CHARUSAT)

FACULTY OF TECHNOLOGY & ENGINEERING

(FTE)

CHOICE BASED CREDIT SYSTEM

FOR

BACHELOR OF TECHNOLOGY & ENGINEERING

CHOICE BASED CREDIT SYSTEM

With the aim of incorporating the various guidelines initiated by the University Grants Commission (UGC) to bring equality, efficiency and excellence in the Higher Education System, Choice Based Credit System (CBCS) has been adopted. CBCS offers wide range of choices to students in all semesters to choose the courses based on their aptitude and career objectives. It accelerates the teaching-learning process and provides flexibility to students to opt for the courses of their choice and / or undergo additional courses to strengthen their Knowledge, Skills and Attitude.

1. CBCS – Conceptual Definitions / Key Terms (Terminologies)

Types of Courses: The Programme Structure consist of 4 types of courses: Foundation courses, Core courses, Elective courses and Non-credit (audit) courses.

1.1. Foundation Course

These courses are offered by the institute in order to prepare students for studying courses to be offered at higher levels.

1.2. Core Courses

A Course which shall compulsorily be studied by a candidate to complete the requirements of a degree / diploma in a said programme of study is defined as a core course. Following core courses are incorporated in CBCS structure:

A. University Core courses(UC):

University core courses are compulsory courses which are offered across university and must be completed in order to meet the requirements of programme. Environmental science will be a compulsory University core for all Undergraduate Programmes.

B. Programme Core courses(PC):

Programme core courses are compulsory courses offered by respective programme owners, which must be completed in order to meet the requirements of programme.

1.3. Elective Courses

Generally, a course which can be chosen from a pool of courses and which may be very specific or specialised or advanced or supportive to the discipline of study or which provides an extended scope or which enables an exposure to some other discipline / domain or nurtures the candidates proficiency / skill is called an elective course. Following elective courses are incorporated in CBCS structure:

A. University Elective Courses(UE):

The pool of elective courses offered across all faculties / programmes. As a general guideline, Programme should incorporate 2 University Electives of 2 credits each (total 4 credits).

B. Institute Elective Course (IE)

Institute ekective courses are those courses which any students of the University/Institute of a Particular Level (PG/UG) will choose as offered or decided by the University/Institute from time-to-time irrespective of their Programme /Specialisation

C. Programme Elective Courses(PE):

The programme specific pool of elective courses offered by respective programme.

D. Cluster Elective Course (CE):

An ‘Elective Course’ is a course which students can choose from the given set of functional course/ Area or Streams of Specialization options (eg. Common Courses to EC/CE/IT/EE) as offered or decided by the Institute from time-to-time.

1.4. Non Credit Course (NC) - AUDIT Course

A ‘Non Credit Course’ is a course where students will receive Participation or Course Completion certificate. This will be reflected in Student’s Grade Sheet but the grade of the course will not be consider to calculate SGPA and CGPA. Attendance and Course Assessment is compulsory for Non Credit Courses.

1.5. Medium of Instruction

The Medium of Instruction will be English.

Program Outcomes: Mechanical Engineering

PO1 Graduates will demonstrate the knowledge of engineering fundamentals, mathematics, science and engineering specialization to solve complex engineering problem.

PO2 Graduates will exhibit the ability to design, identify, analyze and solve problems related to mathematics, science and engineering.

PO3 Graduates will exhibit the ability to design, solve and develop processes or systems which are cost effective, technologically advanced and meets public health, safety and environmental challenges.

PO4 Graduates will demonstrate ability to design and conduct experiments, analyze and interpret data through simulations to arrive at valid conclusions.

PO5 Graduates will demonstrate the skills to use modern methods of engineering, software tools, high-tech equipment's and facilities to solve various problems.

PO6 Graduates will display their abilities in undertaking problems of technological significance with a motive to serve the society.

PO7 Graduates will demonstrate ability to provide professional engineering solution in the contents of societal and environmental sustainability.

PO8 Graduates will exhibit responsibility in ethical and social issues.

PO9 Graduates will demonstrate the ability to work as an individual, and as a member or leader in diverse team and in multi-disciplinary settings.

PO10 Graduates will be effective in formal and informal communication in both verbal and written form and develop managerial skills.

PO11 Graduates will demonstrate the ability to work on multi-disciplinary problems through engineering and management principles.

PO12 Graduates will develop confidence for self-education and ability for life-long learning.

Program Specific Outcomes: Mechanical Engineering

PSO1 The mechanical engineering graduates will be able to analyze, design, and evaluate the performance of mechanical components and systems by using various technological tools.

PSO2 The mechanical engineering graduates will be able to plan and manufacture mechanical components and systems, including selection of material, method and process automation.

TEACHING & EXAMINATION SCHEME

B. TECH. PROGRAMME IN MECHANICAL ENGINEERING

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY (CHARUSAT) (w.e.f. June 2019)

Revised TEACHING & EXAMINATION SCHEME FOR FOURTH YEAR B. TECH. PROGRAMME IN MECHANICAL ENGINEERING

Level	Course Code	Course Title	Teaching Scheme				Examination Scheme				
			Contact Hours			Credit	Theory		Practical		Total
			Theory	Practical	Total		Internal	External	Internal	External	
Sem-7	**ME441**	Quality Engineering & Assurance	4	0	4	4	30	70	0	0	**100**
	ME442	Computer Aided Design	3	2	5	4	30	70	25	25	**150**
	ME443	Operation Research	3	0	3	3	30	70	0	0	**100**
	ME444	Design of Machine Elements-II	4	2	6	5	30	70	25	25	**150**
	ME445	Alternate Energy Sources	3	2	5	4	30	70	25	25	**150**
	ME446	Project Phase - I	0	6	6	3	0	0	75	75	**150**
	ME47X	Programme Elective - III	3	0	3	3	30	70	0	0	**100**
	ME452	Summer Internship - II *	_	_	_	3	0	0	75	75	**150**
		**(Internship after the 6th sem.)*			**32**	**29**					**1050**
Sem-8	**ME447**	Power Plant Engineering	3	0	3	3	30	70	0	0	**100**
	ME448	Computer Aided Manufacturing	3	2	5	4	30	70	25	25	**150**
	ME449	Industrial Engineering & Management	4	0	4	4	30	70	0	0	**100**
	ME450	Control Engg.	3	2	5	4	30	70	25	25	**150**
	ME451	Project Phase - II	0	8	8	4	0	0	100	100	**200**
	ME47X	Programme Elective - IV	3	2	5	4	30	70	25	25	**150**
					30	**23**					**850**

Programme Electives:

Sr. No.	Course Nature	Course Code	Course Title
1	Programme Elective- III	ME471	Advanced Refrigeration & Air Conditioning
2		ME472	Advanced Machine Design
3		ME473	Composite Materials
4		ME474	Thermal System Design
5		ME475	Product Design & Value Engineering
6		ME476	Robotics
7	Programme Elective- IV	ME477	Optimization Techniques
8		ME478	Industrial Tribology
9		ME479	Surface Engineering
10		ME480	Advanced Manufacturing Technology
11		ME481	Computational Fluid Dynamics
12		ME482	Dynamics of Compressible Flow

B. Tech. (Mechanical Engineering) Programme

SYLLABI

(Semester – 7)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

ME-441 QUALITY ENGINEERING & ASSURANCE

7th Semester and 4th Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	00	4	4
Marks	100	00	100	

A. Objectives of the Course:

- To Study the concept of Quality in a manufacturing industry.
- To provide students details of quality management process.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction to Quality	05
2.	Quality Tools, Techniques & Standards:	07
3.	Statistical Quality Control	13
4.	Designing for Quality	07
5.	Total Quality Management:	07
6.	Reliability	07
7	Quality Assurance Models	07
8.	Trends in Quality Engineering	07

Total hours (Theory): 60

Total hours (Lab): 00

Total: 60

C. Detailed Syllabus:

1 Introduction to Quality 05 Hours 08%

1.1 Different Definitions and Dimensions of Quality

1.2 Evolution of Management Thoughts

1.3 Contribution of Quality Gurus such as - Shewart, Ronald Fisher, Deming, Juran, Feigenbaum, Ishikawa, Crosby, Taguchi

2	Quality Tools, Techniques & Standards	07 Hours	12%
2.1	Seven basic tools.		
2.2	New quality control tools		
2.3	Various quality techniques		
2.4	Quality system Standards		
3	Statistical Quality Control	13 Hours	20%
3.1	Meaning of Statistical Quality Control and Statistical Process Control		
3.2	Theory and applications of control charts;		
3.3	Sampling plans		
3.4	OC curves		
4	Designing for Quality:	07 Hours	12%
4.1	Introduction to Concurrent Engineering,		
4.2	Quality Function Deployment (QFD)–		
4.3	Failure Mode and Effect Analysis (FMEA)		
5	Total Quality Management:	07Hours	12%
5.1	Total Quality Management system		
5.4	Total Quality Management case studies.		
6	Reliability	07 Hours	12%
6.1	Meaning of reliability		
6.2	Maintainability		
6.3	Availability		
7	Quality Assurance Models	07 Hours	12%
7.1	Various Quality standards such as ISO9001, ISO/TS 16949, ISO 14000, ISO 18000 etc		
8	Trends in Quality Engineering	07 Hours	12%
8.1	Overview of various recent trends in Quality Engineering.		

D. **Instructional Methods and Pedagogy**

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi–media projector, black board, OHP etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- In the lectures behaviour will be observed strictly.

E. **Student Learning Outcomes:**

On successful completion of the course, the student will be able to:

1. Recognize meaning of quality.
2. Identify quality tools. Techniques and standards.
3. Demonstrate use of quality control charts.
4. Demonstrate use of FMEA.
5. Assess total quality management system.
6. Evaluate reliability of a component.
7. Identify Quality assurance model.
8. Rank trends in Quality Engineering.

F. **Recommended Study Material:**

Text Books:

1. M. Mahajan "Statistical Quality Control ", Dhanpat Rai & Co. (P) Ltd, 1997.
2. K C Jain and A K Chitale " Quality Assurance and Total Quality Management (ISO 9000, QS 9000 ISO 14000) " Khanna Publishers,2003

Reference books:

1. Joseph Juran and A. Blanton Godfrey, "Juran's Quality Handbook", McGraw Hill, 1999
2. Grant, E., and Leavenworth, R., "Statistical Quality Control", McGraw Publishing company limited-New Delhi 7^{TH} edition, 2000
3. Mitra, A., "Fundamentals of Quality Control and Improvement", John Wiley & Sons, 4^{th} edition 2016
4. Stoner, Freeman, Gilbert, "Management", Pearson Education, New Delhi, 7^{th} Edition 2009
5. Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield, Mary Besterfield-Sacre, Hermant Urdhwareshe, Rashmi Urdhwareshe., "Total Quality Management", Pearson Education

India,3rd 2011

6. Srinath L. S., "Reliability Engineering", 4th edition, Affiliated East West Press, 2005
7. I. R. Miller, J. E. Freund and R. Johnson, "Probability and Statistics for Engineers", Prentice Hall, 2002.
8. B. L. Hanson and P. M. Ghare, "Quality Control & Application", Prentice Hall of India, 2009
9. K.S. Krishnamoorthi, V. Ram Krishnamurthy A First Course in Quality Engineering: Integrating Statistical and Management Methods of Quality, Second Edition CRC Press, 2011
10. Hans-Joachim. Mittag, Horst Rinne Statistical Methods of Quality Assurance CRC Press, 1993

Web Material:

1. http://nptel.ac.in/courses/Webcourse-contents/IIT-ROORKEE/INDUSTRIAL-ENGINERRING/index.htm
2. Quality forum of India. http://qcfi.in.
3. Quality engineering journal. https://www.tandfonline.com/loi/lqen20
4. International Journal of Quality Engineering and Technology http://www.inderscience.com/jhome.php?jcode=ijqet

ME-442 COMPUTER AIDED DESIGN

7^{th} Semester and 4^{th} Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objectives of the Course:

- To give students greater depth of technical knowledge in the areas of designs using modeling and analysis software's.
- To learn detailed engineering of 3D models and application of computer system to a solution of design problem.
- To understand the need in design for the finite element method.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Fundamentals of CAD	02
2.	Fundamentals of Computer Graphics	12
3.	Geometric Modeling	08
4.	CAD standards	02
5.	Introduction to Finite Element Method	18
6.	Design Optimization	03

Total hours (Theory): 45

Total hours (Lab): 30

Total: 75

C. Detailed Syllabus:

1. Fundamentals of CAD **02 Hours 05%**

1.1 Introduction to CAD and Design process

1.2 Application of computer for design, Product Cycle and CAD-CAM integration

1.3 Benefits of CAD, CAD work station: Hardware & Software

2. Fundamentals of Computer Graphics **12 Hours 26%**

2.1 Introduction to Computer graphics

2.2 Scan conversions and Algorithm for generation of line and circle, Elements of CAD Programming

2.3 2D and 3D Transformations and Composite Transformations

3. Geometric Modeling **08 Hours 18%**

3.1 Representation of curves and surfaces

3.2 Geometric modeling techniques

3.3 Wireframe modeling, Surface Modeling and Solid Modeling

3.4 Feature based Parametric modelling

4. CAD standards **02 Hours 05%**

4.1 Standards in CAD, Graphics and computing standards

4.2 Data exchange standards, Design database

5. Introduction to Finite Element Method **18 Hours 40%**

5.1 Introduction to FEM, Role of FEM in Design cycle and Historical background

5.2 Stresses and equilibrium, Boundary conditions, Strain-Displacement relations, Plane stress and plane strain cases.

5.3 Concept of Raleigh-Ritz and Galerkin's methods, Review of matrix algebra

5.4 Generalized procedure for solving a problem using Finite element analysis

5.5 Types of elements, Finite element modeling and Formulation of Stiffness matrix

5.6 Concept of shape functions and Natural Coordinates

5.7 Thermal effects in 1 D Elements

5.8 1 D structural design problems with Elimination and Penalty Approaches

5.9 Quadratic shape function and analysis of Trusses with Concept of thermal effects

5.10 Applications and capabilities of various software for FEA

6. Design Optimization **03 Hours 06%**

6.1 Introduction to optimum design

6.2 Johnson's method of optimum design

6.3 Normal, Redundant and Incompatible specifications

D. **Instructional Methods and Pedagogy**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory
- Internal Exams/Unit Tests/Surprise Tests/ Quizzes/Seminar/Assignments etc. will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. **Student Learning Outcomes:**

On successful completion of this course, the student will be able to:

1. Apply the role of graphic communication in the engineering design process.
2. Create a 3D model and technical drawing for a simple, well-defined part or assembly in any CAD software.
3. Understand parametric modeling techniques to reflect engineering requirements.
4. Understand the theoretical basis of the Finite Element Method in the engineering design process.

Generate Finite Element models and solve a selected range of engineering problems in commercial Finite Element package.

F. **Recommended Study Material:**

Text Books:

1. Hearn Donald and Baker Pauline, "Computer Graphics", Prentice-Hall of India Pvt. Ltd.,
2. Haideri Farazdak, "CAD/CAM and Automation"Rao, Nirali Prakashan.
3. Rao P N, "CAD/CAM: Principles and Applications", McGraw Hill Publication.
4. Chandrupatla and Belagundu, "Finite Elements in Engineering", Prentice Hall of India Private Ltd.
5. Logan Daryl, "A first course in the Finite Element Method", Cengage Learning.

Reference Books:

1. Rogers David F. and Adams J. Alan, "Mathematical Elements for Computer Graphics" McGraw H

1990.
2. Rao S.S., “Finite Element Method in Engineering”, Elsevier Pergaman Press.
3. Lee Kunwoo, “Principles of CAD/CAM/CAE Systems”, Addison Wesley Pub Co,.
4. Zeid Ibrahim, “Mastering CAD/CAM”, Tata McGraw Hill, 2009
5. Chris Mc Mohan, “CAD/CAM: Principles, Practice and Manufacturing”, Prentice Hall.
6. Mortenson M E, “Geometric modeling”, Industrial Press.
7. Reddy J.N., “An Introduction to the Finite Element Method”, McGraw Hill, Int. Edition.
8. Rao S.S., “Engineering optimization: Theory and practice” New Age International Publications.
9. Haideri Farazdak, “Mechanical System Design”, Nirali Prakashan.

Web Material:

1. http://nptel.ac.in/courses/112102101/

Other Material:

1. Programming Languages: C, C^{++}, MATLAB
2. Software’s: AutoCAD, Pro/Engineer, ANSYS
3. ASME Journal of Mechanical Design (http://asmedl.aip.org/MechanicalDesign)
4. IEEE Computer Graphics and Applications (https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=38)
5. IE Mechanical Engg.
6. www.sciencedirect.com
7. SADHNA (Engineering Science) (http://www.ias.ac.in/sadhana/)

ME – 443 OPERATION RESEARCH

7^{th} Semester and 4^{th} Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	0	3	3
Marks	100	0	100	

A. Objectives of the Course:

- To develop understanding among the students about operation research and commonly used techniques in operation research.
- To develop ability of a student to make and use different models and techniques to solve real life/practical/industrial problems related to operation research.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Basics of operation research	02
2.	Linear programming	16
3.	Transportation models	05
4.	Assignment models	03
5.	Games theory	05
6.	Replacement models	04
7.	Queuing theory	04
8.	Dynamic programming	06

Total Hours (Theory): 45

Total Hours (Lab): 00

Total Hours: 45

C. **Detailed Syllabus:**

1	**Basics of Operations Research**	**02 Hours**	**04%**
1.1	Definition, characteristics, phases, scope and limitations of OR		
2	**Linear Programming Methods**	**16 Hours**	**36%**
2.1	Formulation of problem, Graphical method, Simplex method		
2.2	Big M method, Two phase method, Degeneracy		
2.3	Unboundedness, Infeasibility, Cycling, Duality		
2.4	Solution of Linear Equations by Simplex method		
2.5	Sensitivity Analysis		
3	**Transportation Models**	**05 Hours**	**11%**
3.1	North West Corner rule, Least cost method, Vogel's approximation method		
3.2	Degeneracy in transportation problem, stepping stone method, Modified Distribution Method (MODI's method)		
3.3	Unbalanced supply and demand, profit maximization problem, prohibited transportation routes, transshipment problems		
3.4	Shortest route problem, minimum spanning tree problem, and maximum flow problem		
4	**Assignment Models**	**03 Hours**	**7%**
4.1	Hungarian method for solution, non-square matrix, restriction on assignments, Maximization problem, Traveling Salesman Problem (TSP)		
5	**Game Theory**	**05 Hours**	**11%**
5.1	Terms used in game theory, Two person zero sum games, pure strategy, matrix reduction by dominance, mixed strategies (2x2, 2xn, mx2, 3x3 games)		
5.2	Algebraic, arithmetic and graphical method.		
6	**Replacement Models**	**04 Hours**	**09%**
6.1	Introduction, Reasons for Replacement Equipment, Emergence of Equipment Replacement		
6.2	Replacement Models, MAPI Method, Sudden Failure Items, Failure Trees		
7	**Queuing theory**	**04 Hours**	**09%**
7.1	Elements of Queuing System, Characteristics of Waiting Lines, Service Discipline		
7.2	Service Mechanism		

8 Dynamic Programming **06 Hours 13%**

8.1 Introduction, Bellman's principle of Optimality, solution of problems with finite number of stages

8.2 Solution of LPP by dynamic programming

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject, course outcomes, learning outcomes will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- In the lectures discipline and behaviour will be observed strictly.

E. Students Learning Outcomes:

1. Students will be able to understand various quantitative techniques and their role in problem solving.
2. They will be able to select and apply tools and find appropriate solutions to decision making problems.
3. Students can recognize the importance and value of Operations Research and mathematical modeling in solving practical problems in industry.
4. Students can understand Operations Research models and apply them to real-life problems.
5. Students will be able to build and solve Transportation Models and Assignment Models.

F. Recommended Study Material:

Text Books:

1. Sharma J.K., "Operations Research: Theory and Applications", Trinity Laxmi Publications, New Delhi.
2. Hira D. S. and Gupta P. K., "Operations Research", S. Chand Publications.
3. Verma A .P, "Operation Research", S K Kataria and Sons, New Delhi.
4. Sen Rathindra P., "Operation Research: Algorithms and applications", Prentice Hall of India, New Delhi.
5. Vohra N. D., "Quantitative Techniques in Management", Tata McGraw Hill, New Delhi.
6. 12) Kapoor V. K., "Operations Research: Quantitative Techniques for Management", Sultan

Chand and Sons.

Reference Books:

1. Pannerselvam R., "Operations Research", Prentice Hall of India, New Delhi
2. Sharma J. K., "Operations Research: Problems and Solutions", Macmillan India Ltd
3. Wagner, "Principles of Operations Research: With Applications to Managerial Decisions", Prentice Hall of India, New Delhi
4. Taha Hamdy, "Operations Research: An Introduction", Prentice Hall India
5. Hillier and Lieberman, "Introduction to Operations Research", Tata McGraw Hill
6. Kalavathy S., "Operation Research", Vikas Publishing House, Noida
7. Natarajan A. M., Balasubramani P. and Tamilarasi A., "Operations Research", Pearson Education
8. Winston and Goldberg, "Operations Research: Applications and Algorithms", Thomson Brooks
9. Maurice Saseini, Arhur Yaspan and Lawrence Friedman, "Operations Research: Methods and Problems", Wiley

Web Material:

1. http://nptel.ac.in

Other Material:

1. Programming Languages: MATLAB
2. Science Direct Journal (http://www.sciencedirect.com)
3. IEEE transactions (http://ieeexplore.ieee.org)
4. Mechanical Engg. (Inst. of Engineers) http://www.ieindia.org

ME 444: DESIGN OF MACHINE ELEMENTS II
7th Semester and 4th Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	2	6	5
Marks	100	50	150	

A. Objectives of the Course:

A. To develop analytical and practical abilities for providing solutions for design machine components with the help of National/International standards.

B. Understand to design various types of gears, gearbox, bearings and IC engine components as per ASME Standards.

C. Recognizing factors affecting for constituting practical, functional, efficient and safe design of mechanical components.

D. To provide background for higher level courses in Mechanical Engineering.

E. To design and analyze the components with help of modelling and analysis based software's in practical session.

B. Outline of the Course:

Sr. No.	Title of the Unit	Min no. of Hrs.
1.	Statistical and Ergonomics Consideration in Design	04
2.	Gear Design	13
3.	Design of Gear Box	12
4.	Design of Sliding Contact Bearings	08
5.	Design of Rolling Contact Bearings	08
6.	Design of I.C. Engine Components	15

Total Hours (Theory): 60

Practical Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1	**Statistical and Ergonomics Consideration in Design**	**04 Hours**	**07%**
1.1	Reliability based design of machine components and Hazard rate, MTBF		
1.2	Aesthetics and Ergonomics in design		
2	**Gear Design**	**13 Hours**	**22%**
2.1	Introduction to gear terminology, law of gearing, interference and undercutting, gear materials		
2.2	Gear tooth failures, basic theory of gear design- Lewis equation, beam strength, wear strength, etc.		
2.3	Design of Spur Gear, Helical Gear, Bevel Gear, Worm Gear		
3	**Design of Gear Box**	**12 Hours**	**20%**
3.1	Speed reducers and gear box		
3.2	Structural diagram, speed chart and Ray diagram		
3.3	Design procedure		
4	**Design of Sliding Contact Bearings**	**08 Hours**	**13%**
4.1	Introduction and classification of bearing		
4.2	Basics mode of lubrication, Petroff's equation, Mckee's investigation		
4.3	Bearing design- selection of parameters		
4.4	Design of hydrodynamics bearing, Raimondi and Boyd's methods		
4.5	Sliding contact bearing failure- causes and remedies		
5	**Design of Rolling Contact Bearings**	**08 Hours**	**13%**
5.1	Introduction		
5.2	Types of rolling contact bearings, Principle of self-aligning bearing		
5.3	Static load carrying capacity, Stribeck's equation and dynamic load carrying capacity		
5.4	Load-life Relationship		
5.5	Preloading and mounting of bearings, lubrication of rolling contact bearing		
5.6	Rolling contact bearing failure- causes and remedies		
6	**Design of I.C. Engine Components**	**15 Hours**	**25%**
6.1	Design of cylinder, piston and piston rod		
6.2	Design of connecting rod, crank and crank shaft		

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, green board etc.
- Attendance is compulsory in lectures and in practical sessions.
- Internal exams / Unit tests / Surprise tests / Quizzes / Seminar / Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit / topic and will be evaluated at regular interval.
- Tutorials related to course content will be carried out in the practical.
- In the lectures discipline and behavior will be observed strictly.
- Industrial Visits will be organized for students to explore industrial facilities. Students are required to prepare a report on industrial visit and submit as a part of assignment.

E. Students Learning Outcomes:

Upon successful completion of this course, the student will be able to:

A. Learn design methodology for various machine elements e.g. spur gear, helical gear, bevel gear and worm gear etc.
B. Design gearbox, sliding contact bearing, rolling contact bearing, IC engine components for explicit applications.
C. Use design data book to design machine components using diverse codes as per required for industrial aspects and applications.

F. Recommended Study Material:

Text Books:

1. Bhandari V. B., "Design of Machine Elements", Tata McGraw Hill Publishing Co.
2. Haideri Farazadak, " Machine Design ", Vol.- I, II, III, Nirali Prakashan - Pune.
3. PSG design data book

Reference Books:

1. Shigley Joseph Edward, "Machine Design", McGraw-Hill Professional Publishing.
2. Dieter George, "Engineering Design", McGraw-Hill Publishing, 4th Edition 2008.
3. Singh Sadhu, "Machine Design", Khanna Publishers, New Delhi.

Other material:

1. Engineering Failure Analysis, Science Direct Journal, ISSN: 1350–6307.
2. Journal of Materials and Design, ELSEVIER PUBLICATION.
3. IE Mechanical Engineering.

ME- 445 ALTERNATIVE ENERGY SOURCES

7th Semester and 4th Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. **Objectives of the Course:**

- To make the students aware and able to understand about the non-conventional energy sources and its scope so that they get a sound knowledge of the important aspects of them.
- To know about various applications of non-conventional energy sources which play an important role in industries as well as in our day-to-day life.

B. **Outline of the Course:**

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction	2
2.	Solar Energy	13
3.	Wind Energy	6
4.	Biogas and Biomass	8
5.	Ocean Energy	5
6.	Geothermal Energy	3
7.	MHD Power Plants	3
8.	Energy Management	5

Total Hours (Theory):45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1	**Introduction**	**02 Hours**	**5%**
1.1	Man and energy, energy forms, World's and India's production and reserves of energy, Global and national energy scenarios, Need for alternate sources.		
2	**Solar Energy**	**13 Hours**	**44%**
2.1	Solar geometry, extra-terrestrial radiation, spectral distribution, solar radiation at the earth's surface, earth-sun angles, derived solar angles, sunrise, sunset and day length		
2.2	Instruments for solar radiation measurements, estimation of average solar radiation, radiation on tilted surface. Solar collectors material, types and performance analysis		
2.3	Collector efficiency, overall loss coefficient, collector efficiency factor, solar air heaters-types, performance, applications, focusing collector and its types, tracking, performance, non-focusing type collectors, CPC, optical losses		
2.4	Applications of Solar Energy		
3	**Wind Energy**	**06 Hours**	**14%**
3.1	Introduction, power in wind, power coefficient, wind mills-types, design consideration, performance, site selection, advantages and disadvantages, applications, wind energy development in India		
4	**Biogas and Biomass**	**08 Hours**	**14%**
4.1	Introduction, types of biogas plants, biogas generation, factors affecting biogas generation, design consideration, advantages and disadvantages		
4.2	Applications, biomass energy, energy plantation, gasification, types and application of gasifiers		
5	**Ocean Energy**	**05 Hours**	**10%**
5.1	Introduction, OTEC principle, open cycle OTEC system, closed cycle, hybrid cycle		
5.2	Energy from tides, estimation of tidal power, tidal power plants, single basin, double basin, advantages and limitations wave energy, wave energy conversion devices, advantages and disadvantages		
6	**Geothermal Energy**	**03 Hours**	**3%**
6.1	Introduction, vapour dominated system, liquid dominated system, binary cycle, hot dry rock resources, magma resources, advantages and disadvantages, applications, geothermal energy		

in India: prospects

7 MHD Power Plants **03 Hours 4%**

7.1 Introduction, Principle of MHD power generation, open cycle plant, closed cycle plant, liquid metal system, advantages of MHD plants

8 Energy Management **05 Hours 6%**

8.1 Energy economics, energy audit, energy conservation, cogeneration, waste heat recovery, concept of total energy system, combined cycle plant, energy management, scope of alternate energy sources in India

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

On successful completion of the course, the student will be able to:

- Understand the basic about the conventional energy resources and their effective utilization.
- Acquire the knowledge of modern energy conversion technologies.
- Understand principles of energy conversion from alternate sources including solar, wind, geothermal, ocean, biomass, biogas and hydrogen.
- Evaluate performance of solar water heater, solar drier and solar still.
- Operate the instrument related to solar radiation measurement.

F. Recommended Study Material:

Text Books:

1. Rai G. D, "Non- Conventional Energy Source", Khanna Pub.

2. Sukhatme S. P. "Solar Energy", Tata McGraw Hill Pub
3. Domkundwar " Solar energy and non-conventional energy sources" Dhanpat Rai publication

Reference Books:

1. Khan B. H. "Non-conventional energy resources", Tata McGraw Hill Pub
2. Krieth Frank and Kreider John F ,"Principles of Solar Energy", John Wiley and sons, New York.
3. Gargand H. P. , Jai Prakash, "Solar Energy : Fundamentals and Applications", Tata McGraw Hill
4. Duffic J. A. and Beckman W. A. "Solar Engineering of Thermal Processes", John Wiley and sons, New York.
5. Giri N. K . "Alternate energy sources and application", Khanna Pub
6. Raja et. al, "Non-conventional energy sources". Scitech Publications Chennai

Web Materials:

1. http://nptel.iitm.ac.in/courses.php?disciplineId=112

Other Materials:

1. www.mnre.gov.in Renewable Energy, Akshay Urja
2. Sadhna: http://www.ias.ac.in/sadhana/
3. Sciencedirect.com (Alternative energy sources)

ME– 446 PROJECT PHASE- I

7th Semester and 4th Year

·Cedits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	-	6	6	3
Marks	-	150	150	

A. **Objectives of the Course:**

- To develop skills in the students whereby they apply the totality of knowledge and skills gained through the other courses for solving a particular problem or executing a project.
- To expose them to the modern modes of technical communication and presentation.
- To provide platform that allows students to continually demonstrate their learning and group work capabilities.
- To provide background for higher level subjects like Major Project – II for the forthcoming semester.

B. **Outline of the Course:**

- Major project-I involves analysis, design, and implementation and testing of substantial hardware, software or any combination in the field of study.
- Each student will apply the knowledge of the subjects studied in the previous semesters and present it in the form of comprehensive presentation along with a project report.
- Project will be mostly in-house and/or based on industry problems, where a student's project work involves analysis, synthesis, material selection and detailed design of a mechanical system. Projects may be selected by students from any relevant area of mechanical engineering and/or based on mechanical engineering application.

Total Hours (Theory): 00

Total Hours (Lab):60

Total Hours: 60

C. **Instructional Method and Pedagogy:**

- Students will select related topic based on subjects they learnt and with the aid of books, periodicals, journals and various web resources.
- Students will be taught to make presentations and report based on it.
- Faculty will suggest modifications to improve the technical subject matter and presentation skills.
- The project assignment can be individual assignment or a group assignment. However a project group will not consist of more than 4 students.
- Students have to prepare a project report of 25 pages. The report typed on A4 sized sheets and bound in the necessary format should be submitted after approval by the faculty and endorsement of the Head of Department.
- At the end of semester student has to give a comprehensive presentation to the teachers of the department and his classmates. The teacher based on the quality of work and preparation and understanding of the candidate shall do an assessment of the project.
- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Attendance is compulsory in laboratory.
- Research / technical papers in relevant areas must be covered.

D. **Students Learning Outcomes:**

On successful completion of this course, the student will be able to:

1. Identify a topic in areas of mechanical engineering as well as from the issues faced by industries.
2. Review literature to identify gaps and define objectives, methodology for the work.
3. Formulate and implement innovative ideas for social and environmental benefits.
4. Illustrate their analytical, compilation and editing skills and develop the art of an in-depth presentation.
5. Organize a work with team members.

E. **Recommended Study Material:**

1. Science Direct: www.sciencedirect.com
2. Indian Journal of Engineering and Material Sc. (www.niscair.res.in)
3. Sadhna (Engineering Science) (http://www.ias.ac.in/sadhana/)
4. IE: Mechanical Engg, Metallurgical and Materials Engg and Production Engg.

ME – 452 SUMMER INTERNSHIP - II

7th Semester and 4th Year

Credits and Hours:

Teaching Scheme	Project	Total	Credit
Hours/week	-	-	3
Marks	150	150	

A. Objectives of the Course:

Summer internships are required to be carried out in order to help students to find and know the applications of their theoretical knowledge enhance their company/industry/organization experience, get familiar with the company/industry/organization culture and work ethics.

The main objectives for offering the internship for the students are:

- To get perspective and experience of the field
- To make them company/industry/organization ready
- To get familiar with modern tools and technologies
- To enhance technical writing skills in reporting as per the company/industry/organization standards
- To get involved in design, development and testing practices followed in the company/industry/organization
- To enhance their soft-skills, presentation skills, interpersonal skills, documentation skills and office etiquettes required to sustain in company/industry/organization environment
- To participate in teamwork and preferably as part of a multi-disciplinary team
- To understand the professional and ethical responsibilities of an engineer
- To make them more productive, consistent and punctual
- To make them aware about company/industry/organization best practices, processes and regulations

B. Instructional Method and Pedagogy:

- Summer internship shall be at least 90 hours during the summer vacation only.
- Department/Institute will help students to find an appropriate company/industry/organization for the summer internship.
- The student must fill up and get approved a Summer Internship Acceptance form by the company and provide it to the Coordinator of the department within the specified deadline.
- Students shall commence the internship after the approval of the department Coordinator. Summer internships in research center is also allowed.
- During the entire period of internship, the student shall obey the rules and regulations of the company/industry/organization and also those of the University.
- Due to inevitable reasons, if the student will not able to attend the internship for few days with the permission of the supervisor, the department Coordinator should be informed via e-mail and these days should be compensated later.
- The student shall submit two documents to the Coordinator for the evaluation of the summer internship:
    - Summer Internship Report
    - Summer Internship Assessment Form
- Upon the completion of summer internship, a hard copy of "Summer Internship Report" must be submitted to the Coordinator by the first day of the new term.
- The report must outline the experience and observations gained through practical internship, in accordance with the required content and the format described in this guideline. Each report will be evaluated by a faculty member of the department on a satisfactory/unsatisfactory basis at the beginning of the semester.
- If the evaluation of the report is unsatisfactory, it shall be returned to the student for revision and/or rewriting. If the revised report is still unsatisfactory the student shall be requested to repeat the summer internship.

C. Format of Summer Internship Report:

The report shall comply with the summer internship program principles. Main headings are to be centered and written in capital boldface letters. Sub-titles shall be written in small letters and boldface. The typeface shall be Times New Roman font with 12pt. All the margins shall be 2.5cm. The report shall be submitted in printed form and filed. An electronic copy of the report shall be recorded in a CD and enclosed in the report. Each report shall be bound in a simple wire vinyl file and contain the following sections:

- Cover Page
- Page of Approval and Grading
- Abstract page: An abstract gives the essence of the report (usually less than one page). Abstract is written after the report is completed. It must contain the purpose and scope of internship, the actual work done in the plant, and conclusions arrived at.
- TABLE OF CONTENTS (with the corresponding page numbers)
- LIST OF FIGURES AND TABLES (with the corresponding page numbers)
- DESCRIPTION OF THE COMPANY/INDUSTRY/ORGANISATION: Summarize the work type, administrative structure, number of employees (how many engineers, under which division, etc.), etc. Provide information regarding
    - Location and spread of the company
    - Number of employees, engineers, technicians, administrators in the company
    - Divisions of the company
    - Your group and division
    - Administrative tree (if available)
    - Main functions of the company
    - Customer profile and market share
- INTRODUCTION: In this section, give the purpose of the summer internship, reasons for choosing the location and company, and general information regarding the nature of work you carried out.
- PROBLEM STATEMENT: What is the problem you are solving, and what are the reasons and causes of this problem.
- SOLUTION: In this section, describe what you did and what you observed during the summer internship. It is very important that majority of what you write should be based on what you did and observed that truly belongs to the

company/industry/organization.

- CONCLUSIONS: In the last section, summarize the summer internship activities. Present your observations, contributions and intellectual benefits. If this is your second summer internship, compare the first and second summer internships and your preferences.
- REFERENCES: List any source you have used in the document including books, articles and web sites in a consistent format.
- APPENDICES: If you have supplementary material (not appropriate for the main body of the report), you can place them here. These could be schematics, algorithms, drawings, etc. If the document is a datasheet and it can be easily accessed from the internet, then you can refer to it with the appropriate internet link and document number. In this manner you don't have to print it and waste tons of paper.

D. Students Learning Outcomes:

On successful completion of this course, the student will be able to:

1. To apply knowledge and skills learned in company/industry/organization to real-world problems
2. To solve engineering problems
3. To function in a team work
4. To work with teammates from other disciplines
5. To use experience related to professional and ethical issues in the work environment
6. To explain the impact of engineering solutions, developed in a project, in a global, economic, environmental, and societal context
7. To finds relevant sources (e.g., library, Internet, experts) and gather information
8. To demonstrates knowledge of contemporary issues related with engineering in general
9. To use new tools and technologies

B. Tech. (Mechanical Engineering) Programme

SYLLABI

(Semester – 8)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

ME 447: POWER PLANT ENGINEERING
8th Semester and 4th Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	0	3	3
Marks	100	0	100	

A. Objectives of the Course:

- To understand the various components, operations and applications of different types of power plants.
- To study the economics of stationary power plant.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Steam Power Plant	20
2.	Gas Turbine Power Plant	10
3.	Nuclear Power Plant	05
4.	Combined Cycle Plant	04
5.	Economics of power generation	02
6.	Jet propulsion plant	04

Total Hours (Theory): 45

Total Hours (Lab): 00

Total Hours: 45

C. Detailed Syllabus:

1 Steam Power Plant 20 Hours 40 %

1.1 Classification of steam power plant. Layout of modern steam power plant.

1.2 Fuel handling

1.3 Combustion equipment for steam boilers, ash handling, dust collector

1.4 Chimney draught

1.5 Performance of Boilers, Steam condensers, Cooling ponds and cooling towers, 1.6 Pollution and its control.

2 Gas Turbine Power Plant 10 Hours 25%

2.1 Introduction, classification, simple open cycle gas turbine, closed cycle gas turbine, Actual Brayton cycle.

2.2 Means of improving the efficiency and specific output of simple cycle, open cycle gas turbine with regeneration, reheating inter cooling.

2.3 Effect of various modifications, effect of operating variables on air rate, actual cycle gas turbine with intercooling, reheat and regeneration, Effect of operating variables on work ratio.

2.4 Water injection, Combustion chambers, closed cycle gas turbine, Turbine Blade material.

3 Nuclear Power Plant 05 Hours 12%

3.1 Introduction, Phenomenon such as fission and fusion, chain reaction, nuclear fuels.

3.2 General components of Nuclear reactor ,Different types of reactors, construction and working of PWR, BWR,CANDU reactor

4 Combined Cycle Plant 04 Hours 10%

4.1 Working on gas and steam turbine – combined cycle. Arrangement combines cycle.

4.2 Advantages of combines cycle, parameters affecting the efficiency of combined cycle. Performance of combined cycle.

5 Economics of power generation 02 Hours 05%

5.1 Introduction, terms and definitions, cost analysis, selection of power plant equipments.

5.2 Economics in plant selection

6 Jet and Rocket propulsion plant 04 Hours 06%

6.1 Introduction to jet propulsion plant, various types of jet propulsion plants and its working.

6.2 Rocket propulsion – introduction and working.

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

- Attendance is compulsory in lectures and carries 10 marks in internal theory evaluation and laboratory attendance carries 5 Marks weightage.
- Two internal exams will be conducted and average of the same will be converted to equivalent of 15 Marks as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5 Marks as a part of internal theory evaluation.
- Surprise tests/Quizzes/Seminar will be conducted which carries 5 Marks as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.
- Industrial Visits will be organized for students to explore industrial facilities. Students are required to prepare a report on industrial visit and submit as a part of assignment.

E. **Students Learning Outcomes:**

On successful completion of the course, the student will be able to:

- Understand different components used in steam power plant.
- Evaluate performance of Boiler and Condenser.
- Analyze working of different nuclear power plant.
- Apply energy conservation equation and heat balance and other fundamental equations of thermodynamics for gas turbine plant.
- Understand working of combined cycle plant.
- Analyze economics of thermal power plant.

F. **Recommended Study Material:**

Text Books:

1. Power Plant Engineering by P.K.Nag, TMH Pub.
2. Power plant Engg. R.K.Rajput., Laxmi Prakashan
3. Thermal Engineering by Domkundwar and Arora., Dhanpatrai Pub

Reference Books:

1. Power Plant Engineering by Domkundwar and Arora., Dhanpatrai Pub

2. Power Plant Engineering by P. C. Sharma., S.K.Katariya and Sons
3. Power Plant Technology by G. D. Rai.,Khanna Pub.
4. Power Plant Technology by El-Wakil, TMH Pub.

Web Materials:

1. http://www.nptel.iitm.ac.in/

Other Materials:

1. www.sciencedirect.com:
   International Journal of Thermal Sciences.
   Experimental Thermal and Fluid Science.
2. SADHNA (Engineering Science): http://www.ias.ac.in/sadhana/
3. IEEE: www.ieeexplore.ieee.org

ME – 448 COMPUTER AIDED MANUFACTURING

8th Semester and 4th Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. **Objectives of the Course:**

- To study use of computer systems to plan, manage and control the operations of a manufacturing plant.
- To study advanced features of CAM so as to be capable of accepting professional responsibilities and to understand the associativity between design and manufacturing.

B. **Outline of the Course:**

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction to CAM	02
2.	NC/CNC Machine Tools	18
3.	Flexible Manufacturing System	08
4.	Group Technology	08
5.	Rapid Prototyping	02
6.	Computer Integrated Manufacturing	07

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1 Introduction to CAM **02 Hours 05%**

1.1 Computer Aided Design, Computer Aided Manufacturing, Reasons for CAD/CAM development, CAD/CAM system, activities, elements and applications

2	**NC/CNC Machine Tools**	**18 Hours**	**40%**
2.1	Fundamentals of NC/CNC Machine Tools: NC, DNC, CNC, Programmable Automation, Components of NC/CNC system, Specification of CNC system, Classification of NC/CNC Machine tools, Nomenclature of NC machine axes, CNC Control System, Automatic tool changer, Automatic Pallet Changer, Machine tool structure, Guideways, Transmission system, Drives and Feedback Devices, NC/CNC tooling		
2.2	Basics of CNC Programming: Coding Systems, Types of Codes, Types of Programming, Programming Functions, Basics of Turning Center and Machining Center Programming, Advanced programming and CAD/CAM based programming		
3	**Flexible Manufacturing System**	**08 Hours**	**17%**
3.1	Introduction, objectives of an ideal FMS, applications, classification, functional components, hardware components		
3.2	FMC, elements of an FMS - NC/CNC machines, coordinate measuring machines, robots, conveyors, AGVs, ASRS		
3.3	FMS layouts, specifications, benefits, limitations, FMS planning and implementation issues.		
4	**Group Technology**	**08 Hours**	**17%**
4.1	Objectives, part families, similarities, design and Manufacturing attributes		
4.2	Classification methods- visual inspection, product flow analysis and coding,		
4.3	Need and types of structure, coding systems, G.T. machine cells and types, concept of composite part, benefits and limitations		
5	**Rapid Prototyping**	**02 Hours**	**05%**
5.1	Fundamentals of Rapid Prototyping, Advantages and Applications of RP		
5.2	Types of Rapid Prototyping Systems		
6	**Computer Integrated Manufacturing**	**07 Hours**	**16%**
6.1	Basic information of CIMS, hardware and software requirement for CIMS, benefits, scope and needs		
6.2	CIMS wheel, elements of CIMS and their role		
6.3	Fundamentals of communication, data base management		

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

On successful completion of this course, the student will be able to:

1. Understand the changes brought in the product cycles with the advent of CAM systems.
2. Understand emerging trends in CNC and Automation.
3. Apply their knowledge to prepare part program for machining processes.
4. Understand advance philosophy in the field of manufacturing.
5. Outline the working behind readily available Computer Aided Manufacturing software.

F. Recommended Study Material:

Text Books:

1. Radhakrishan P. and Subramaniyam S., "CAD, CAM and CIM", New Age International
2. Kundra T. K., Rao P. N. and Tewari N. K., "Numerical control and computer aided manufacturing", Tata McGraw Hill Publishing company Ltd.
3. Zeid I., "CAD/CAM" , Tata McGraw Hill Publishing company Ltd.
4. Agrawal P M and Patel V J, "CNC Fundamentals and Programming", Charotar Pub
5. Pabla and Adithan, "A Text Book of CNC Machines", New Age International

Reference Books:

1. Kant V.S.," Computer Integrated Manufacturing", Prentice Hall India Pub. Company Ltd.
2. Rao P. N., "CAD/CAM", Tata McGraw Hill Publishing company Ltd.
3. Radhakrishnan P, "Computer numerical control machines", New Central Book Agency
4. Koren Y. and Joseph B.U., "Numerical Control of Machine Tools", Khanna Publishers, Delhi.
5. Sadhu Singh, "Computer Aided Design and Manufacturing", Khanna Publishers, Delhi.

6. M.P.Groover, E.W.Zimmers, "CAD/CAM Computer Aided Design and Manufacturing", Prentice Hall of India, New Delhi.
7. Kusiak A., "Intelligent Manufacturing Systems". Prentice Hall India Pub. Company Ltd.
8. Luggen W., Flexible Manufacturing Cells and System, Prentice Hall, England Cliffs, Newjersy, 1991.
9. Pham D. T. and Dimov S. S.," Rapid manufacturing", Springer Verlag, London, 2001.
10. Wohlers T., 'Wohlers Report 2007", Wohlers Associates, USA, 2007.
11. Ghosh A., "Rapid Protopyping: A Brief Introduction", Affiliated East West
12. Cooper G., "Rapid Prototyping Technology: Selection and Application", CRC Press, 2001.
13. Kai C.C., Fai L.H., Sing L.C., "Rapid Prototyping: Principles and Applications", World Scientific, 2003.

Web Material:

1. http://nptel.iitm.ac.in

Other Material:

1. Programming Languages: C, C++, MATLAB
2. Software's: Master CAM, Pro/Engineer
3. International Journal of Mechanical Sciences (www.sciencedirect.com)
   Journal of Materials Processing Technology (www.sciencedirect.com)
4. Mechanical Engg. (Inst. of Engineers) http://www.ieindia.org/publish/mc/mc.htm
   Production Engg. (Inst. of Engineers) http://www.ieindia.org/publish/pr/pr.htm
5. IEEE transactions on Manufacturing Technology
   http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8218
6. IET Manufacturing Engineer http://ieeexplore.ieee.org/servlet/opac?punumber=2189
7. Sadhna (http://www.ias.ac.in/sadhana/)

ME – 449 INDUSTRIAL ENGINEERING & MANAGEMENT

8^{th} Semester and 4^{th} Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	00	4	4
Marks	100	00	100	

A. **Objectives of the Course:**

- To know the concept of management and operation in a manufacturing industry.
- To understand the impact of work behaviour and productivity.

B. **Outline of the Course:**

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction to Management and Organization	08
2.	Facilities Design , Plant Maintenance And Safety Engineering	07
3.	Mechanical Estimating , Break Even Analysis and Inventory Management	10
4.	Introduction to Production and Operations Management	15
5.	Introduction to Production design and development	04
6.	Introduction To Work Study	12
7.	Recent Trends in Industrial Engineering	04

Total Hours (Theory): 60

Total Hours (Lab): 00

Total Hours: 60

C. **Detailed Syllabus:**

1 Introduction to Management **07 Hours 10%**

1.1 Evolution of Management Thoughts

1.2	Various theories of Managements.		
1.3	Various functions of Managements.		
2	**Facilities Design , Plant Maintenance And Safety Engineering**	**07 Hours**	**10%**
2.1	Plant location, Plant Layout.		
2.2	Plant Maintenance		
2.3	Plant safety with Occupational Health and safety		
3	**Mechanical Estimating , Break Even Analysis and Inventory Management**	**06 Hours**	**10%**
3.1	Mechanical estimating for different processes.		
3.2	Breakeven point and its use.		
3.3	Inventory control.		
4	**Introduction to Production and Operations Management**	**08 Hours**	**12%**
4.1	Production System		
4.2	Production Planning And Control		
4.3	Sales Forecasting		
4.4	Material Planning		
45	Loading and scheduling		
5	**Introduction to Production design and devlopment**	**04 Hours**	**10%**
5.1	Production design		
5.4	Production development		
6	**Introduction to Work Study**	**08 Hours**	**10%**
6.1	Definition, Objectives of Work study		
6.2	Method study		
6.3	Work measurement		
6.4	Introduction to Ergonomics.		
7	**Recent Trends in Industrial Engineering**	**05 Hours**	**10%**
7.1	Overview of various recent trends in industrial management such as six sigma verses three sigma , Lean Six Sigma, World Class Manufacturing etc.		

D. **Instructional Method and Pedagogy:**

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- In the lectures behavior will be observed strictly.

E. **Students Learning Outcomes:**

On successful completion of the course, the student will be able to:

9. Understand the fact of industrial management process in an industry.
10. Know the impact of principles of scientific management on work behavior & productivity.
11. Study the different types of layout.
12. Identify the safety aspects and maintenance practices in an organization.
13. Apply different work measurement techniques in work study.
14. Identify production planning and control activities

F. **Recommended Study Material:**

Text Books:

1. Koontz H. and Heinz Weihrich, "Essentials of Management: An International, Innovation, and Leadership Perspective", McGraw-Hill, education India Pvt ltd New Delhi, 10th Edition.2015
2. Khanna O. P., "Industrial Engineering and Management", Dhanpat Rai and sons, New Delhi ,1989

Reference Books:

1. Banga T.K, Sharma S.C. and Agrawal, "Industrial Engineering and Management Science", Khanna Publishers, New Delhi .1992
2. Joglekar and Arora, "Industrial Economics Organisation and Management", Khanna Publishers, New Delhi ,2001
3. Amrine, "Manufacturing Organization and Management", Pearson Education, 2nd Edition, 2004.
4. Stoner, Freeman, Gilbert, "Management", Pearson Education, New Delhi, 6th Edition 2005.
5. Pannerselvam, "Production and Operations Management", Prentice Hall, India, 2nd Edition, 2006.

6. Barnes R.M., “Motion and Time Studies”, John Wiley and Sons, 2004.
7. Dessler G., “Human Resource Management”, Pearson Education Asia, 11th Edition.2008
8. Aryasri A.R., “Management Science (JNTU)”, Tata McGraw–Hill, 4th Edition,2008
9. International Labour Organization (ILO), “Introduction to Work Study”, 4th Edition,1992
10. Hall R.H., “Organizations: Structures, Processes and Outcomes” Prentice Hall of India,2009

Web Material:

1. http://nptel.ac.in/courses/Webcourse-contents/IIT-ROORKEE/INDUSTRIAL-ENGINERRING/index.htm
2 http://iiie-india.com/(Indian Institution of Industrial Engineering)

Other Material:

1. http://www.ilo.org/global/lang--en/index.htm.
2. https://www.osha.gov(Journal of Industrial Engineering International)
3. http://www.springer.com/engineering/industrial+management/journal/40092
4. https://www.tandfonline.com/toc/tjci21/current(Journal of Industrial and Production Engineering)

ME-450 CONTROL ENGINEERING
8th Semester and 4th Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objectives of the Course:

- To give students exposure to Control theory and techniques.
- To demonstrate the role of control systems through different examples.
- To learn the modeling of controllers for different types of control systems and its applications.
- To learn the concept of steady state and transient response of a control system and its stability.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Basic Control System	07
2.	Block Diagrams And Signal Flow Graph	07
3.	Automatic Controllers	12
4.	Hydraulic System	07
5.	Pneumatic Systems	06
6.	Microprocessor Based Digital Control	06

Total hours (Theory): 45 Hours

Total hours (Lab): 30 Hours

Total: 75 Hours

C. Detailed Syllabus:

1.	**Basic Control System**	**07 hours**	**16%**
1.1	Introduction to control systems		
1.2	Concept of feedback referred to linear control systems		
1.3	Definition And Terminology		
1.4	Classification of Control Systems		
1.5	Examples of Control Systems for mechanical engineering systems like thermal power plants, boiler, refrigeration plants, central air-conditioning plants and automobiles.		
1.6	Mathematical Modeling of Physical Systems		
2.	**Block Diagrams And Signal Flow Graph**	**07 hours**	**16%**
2.1	Block Diagram Algebra		
2.2	Transfer Function From A Block Diagram		
2.3	Mason's Gain formula		
2.4	Transfer Function From A Signal Flow Graph		
2.5	Comparison Of Block Diagram And Signal Flow Graph Methods.		
3.	**Automatic Controllers**	**12 Hours**	**24%**
3.1	Basic control actions and controllers		
3.2	Steady – state analysis		
3.3	Transient response of first order and second order systems to step, ramp and sinusoidal input, steady state errors		
3.4	Routh's stability criteria		
3.5	Root locus methods		
4.	**Hydraulic System**	**07 Hours**	**15%**
4.1	Characteristic of hydraulic components, control valves		
4.2	Sources of hydraulic power hydraulic meters, pistons and transmission		
4.3	Elements of circuit design		
5.	**Pneumatic systems**	**06 Hours**	**14%**
5.1	System components of a Pneumatic System and control valves		
5.2	Pneumatic Circuit Design		
6.	**Microprocessor Based Digital Control**	**06 Hours**	**15%**
6.1	Industrial logic control system – programmable logic controller and its applications		

6.2 Logic concepts for PLC and number systems

6.3 Programming od PLC using Ladder logic

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board etc.
- Attendance is compulsory in lectures and laboratory which carries a 5% component of the overall evaluation.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weight age of 5%.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted which carries 5% component of the overall evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.
- Industrial Visits will be organized for students to explore industrial facilities. Students are required to prepare a report on industrial visit and submit as a part of assignment.

E. Students Learning Outcomes:

On successful completion of the course, the student will be able to:

1. At the end of the course the students will learn the various types of control systems and their applications.
2. Students will learn techniques for modeling a control system.
3. Students will learn various techniques related to stability analysis of a control system.
4. Students will learn the hydraulics and pneumatics along with circuit design.
5. Students will get hands on practice on Programmable Logic Controller and related software.

F. **Recommended Study Material:**

Text Books:

1. Ogata K, “Modern Control Theory”, Pearson Education, 2005
2. Nagrath & Gopal, “Control Systems Engineering”, New Age International Publishers, 2008
3. L.A.Bryan and E.A.Bryan, “Programmable controlers, Theory and applications”, An Industrial Text Company Publication Atlanta ● Georgia ● USA

Reference Books:

1. Kuo, Benjamin.C, “Automatic Control System” Prentice Hall of India, 2010
2. Nise, Norman S John , “Control Systems Engineering”, Wiley India, 2009.
3. S K Bhattacharya , “Control Systems Engineering”, Pearson Education, 2009
4. D.Ganesh Rao, K. Chennavenkatesh, “Control Engineering”, Pearson Education, 2010

Web Materials:

1. https://onlinecourses.nptel.ac.in/noc18_me28/course

Other Materials:

1 Programming Languages & Software’s: LabView

2. Science Direct Journal (http://www.sciencedirect.com)
3. IEEE transactions (http://ieeexplore.ieee.org)
4. Mechanical Engineering (Inst. of Engineers) http://www.ieindia.org/publish/mc/mc.html

ME- 451 PROJECT PHASE- II

8th Semester and 4th Year

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	-	8	8	4
Marks	-	200	200	

A. Objectives of the Course:

- To make students familiar about the latest technology trends in the field of Mechanical Engineering.
- To develop skills in the students whereby they apply the totality of knowledge and skills gained through the programme in the solution of particular problem or undertaking a project.

B. Outline of the Course:

- Project will be mostly in-house and/or based on industry problems, where a student's work involves analysis, synthesis, material selection and detailed design of a mechanical system. Projects may be selected by students from any relevant area of mechanical engineering and/or based on mechanical engineering application.
- Major project-II involving design and/or fabrication, modeling, simulation, industry based survey or testing and analysis in the field of study.
- Fabrication of a prototype based on the work done in major project - I. Qualitative performance evaluation and appropriate modification of a prototype.
- Major project-II may be extension of major project-I.

Total Hours (Theory): 00

Total Hours (Lab): 60

Total Hours: 60

C. **Instructional Method and Pedagogy:**

- Students will fabricate the prototype or prepare simulations as per the Major Project I
- Students would be taught to make presentations and report based on it.
- Faculty will suggest modifications to improve the technical subject matter and presentation skills.
- The project assignment can be individual assignment or a group assignment. However, a project group will not consist of more than 4 students.
- Students have to prepare a project report of minimum 25 pages. The report typed on A4 sized sheets and bound in the necessary format should be submitted after approval by the faculty and endorsement of the Head of Department.
- The students have to give a comprehensive presentation, demonstrate the working model if any or run the simulations using the software to the teachers of the department and his/her classmates. The teacher based on the quality of work and preparation and understanding of the candidate shall do an assessment of the project.
- Attendance is compulsory in lectures and laboratory.

D. **Students Learning Outcomes:**

On successful completion of this course, the student will be able to:

1. Organize methods and materials required for the project work.
2. Illustrate the procedures with a concern for ethics.
3. Formulate a prototype/models, experimental set-up, simulation and other systems require meeting the objectives.
4. Analyse and justify the results to conclude the observations.
5. Compile a report and defend the work.
6. Illustrate their analytical, compilation and editing skills and develop the art of an in-depth presentation.
7. Plan financial activities and team work.

E. **Recommended Study Material:**

1. IEEE : www.ieeexplore.ieee.org
2. Science Direct: www.sciencedirect.com
3. Indian Journal of Engineering and Material Science (www.niscair.res.in)
4. SADHNA (Engineering Science) (http://www.ias.ac.in/sadhana/)

B. Tech. (Mechanical Engineering) Programme

SYLLABI

(Electives)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

ME-471 ADVANCED REFRIGERATION AND AIR–CONDITIONING

7^{th} Semester and 4^{th} Year

Program Elective - III

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	0	3	3
Marks	100	0	100	

A. Objectives of the Course:

- The course provides the deep understanding of the principles and methods of Refrigeration and Air Conditioning.
- The course contents help for studying the design and applications of Refrigeration and Air Conditioning in domestic, commercial and industrial sector.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Compound Compression	8
2.	Nonconventional Refrigeration system	8
3.	Cooling Load Calculation	10
4.	Duct Design, Air Distribution	10
5.	Cryogenics	9

Total Hours (Theory): 45

Total Hours (Lab): 00

Total Hours: 45

C. Detailed Syllabus:

1	**Compound Compression**	**08 Hours**	**17%**
1.1	Multi stage compression system, Compound compression with intercooler, System with flash chamber, Two stage compression with flat inter cooler.		
1.2	Multiple evaporator system.		
2	**Nonconventional Refrigeration system**	**08 Hours**	**17%**
2.1	Analysis of steam jet refrigeration system.		
2.2	Analysis of Vortex tube refrigeration system.		
2.3	Analysis of Pulse tube refrigeration system.		
3	**Cooling Load Calculation**	**10 Hours**	**23%**
3.1	Heat flow due to heat conduction, Solar heat load, Load from occupants, Equipment load, Infiltration air load, Miscellaneous heat sources, Fresh air load.		
3.2	Design of Air conditioning system, By-pass factor consideration, Effective sensible heat factor.		
4	**Duct Design & Air Distribution**	**10 Hours**	**23%**
4.1	Air duct, Duct design, Pressure loss, Friction loss, Use of friction chart, Dynamic losses, Losses due to area changes, Methods of duct design, Duct material, Duct work, Duct lay out consideration.		
4.2	Requirements of good distribution system, Terms used in air distribution, Types of Outlets, Outlet location, Selection of Air outlets, Selection procedure with the help of Nomograph, Selection procedure with tables.		
5	**Cryogenics**	**09 Hours**	**20%**
5.1	Gas liquefaction cycle: Ideal systems, Linde, Linde dual pressure system.		
5.2	Cryogenic Instrumentation: Temperature measurements, pressure measurements, flow measurements, liquid level measurements, fluid quality measurements.		
5.3	Cryogenic Applications.		

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

On successful completion of the course, the student will be able to:

1. To enable students to present design aspects of various refrigeration systems and its components
2. To enable students to evaluate refrigeration systems to improve the performance
3. Understanding fundamentals and theory of gas liquefaction system, cryogenic instrumentation and cryogenic applications.
4. Applying fundamentals of cooling load calculation for any practical situation.
5. Analyze different duct design methods and distribution systems.

F. Recommended Study Material:

Text Books:

1. "Refrigeration & Air Conditioning for engineers", P.S. Desai, Khanna Publishers.
2. Barron R., "Cryogenic Systems", Plenum Press
3. ASHRAE Handbook

Reference Books:

1. Arora C.P, "Modern Air Conditioning", McGraw-Hill.
2. Manohar Prasad, "Refrigeration & Air Conditioning", New Age Publishers.
3. Rajput R. K., "Refrigeration and Conditioning", S. K. Kataria and sons publication.
4. Domkundwar and Arora, "Refrigeration and Air Conditioning", Dhanpat Rai & Co.
5. Jordan and Priester, "Refrigeration and Conditioning", Prentice Hall of India.
6. Stoecker W. F., "Refrigeration and Conditioning", Tata McGraw Hill Publication.

Web Material:

1. http://www.nptelvideos.in/2012/12/refrigeration-and-airconditioning.html

ME - 472 ADVANCED MACHINE DESIGN

7th Semester and 4th Year

Program Elective - III

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	0	3	3
Marks	100	0	100	

A Objective of the Course:

- To teach students the concepts of stress analysis, theories of failure and material science to analyze, design and/or select commonly used machine components.
- To teach students mechanical engineering design theory to identify and quantify machine elements in the design of commonly used mechanical systems.
- To develop analytical abilities for providing solutions to engineering design problems.
- To recognize those factors constituting a practical, functional, efficient, and safe mechanical design.

B Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Design Basics and Philosophy	03
2.	Design for strength and rigidity	06
3.	Design based on Fatigue and Creep	07
4.	Design based on Fracture	06
5.	Design Optimization	05
6.	Ergonomics, DFM, QFD-CE, PDD-PC	02
7.	Recent trends in materials handling equipment	12
8.	Design of Experiments	04

Total hours (Theory): 45

Total hours (Practical): 00

Total hours: 45

C Detailed Syllabus:

1	**Design Basics and Philosophy**	**03 Hours**	**7%**
1.1	General design procedure for design problems		
1.2	Design concepts		
1.3	Safe life v/s fail safe design		
1.4	Formation of design team		
2	**Design for strength and rigidity**	**06 Hours**	**13%**
2.1	Design for strength and rigidity		
2.2	Theory of elasticity and plasticity with design analysis		
3	**Design based on fatigue and creep**	**07 Hours**	**16%**
3.1	Design against fatigue		
3.2	Design against creep		
4.	**Design based on fracture**	**06 Hours**	**13%**
4.1	Overview of fracture mechanics		
4.2	Common applications of fracture/fracture prevention		
4.3	Historical development		
4.4	LEFM and EPFM		
4.5	Modes of Loading		
4.6	SIF for various geometries and Loading		
5	**Design optimization**	**05 Hours**	**11%**
5.1	Johnson's method for mechanical engg. design		
5.2	Typical design equation, classification, examples		
6	**Ergonomics, DFM, QFD-CE, PDD-PC**	**02 Hours**	**4%**
6.1	Ergonomics: Human factors considerations in design and applications,		
6.2	DFM: Design for manufacturing – including assembly aspects and other aspects,		
6.3	QFD-CE: Quality function deployment – concurrent engineering,		
6.4	PDD-PC: Product design and development-product cycle		
7	**Recent trends in materials handling equipment**	**12 Hours**	**27%**

7.1 Recent trends in materials handling equipment design

7.2 Design of material handling system, Examples

8 Design of experiments **04 Hours 9%**

8.1 Concepts of Design of Experiments, Examples

D Instructional Methods and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- In the lectures, discipline and behaviour will be observed strictly.

E Student Learning Outcomes:

- Students will develop the ability to make proper assumptions, perform correct analysis while designing specific mechanical components.
- Students will apply optimization techniques to mechanical design problems
- Students will learn to select the material handling equipments, its design principles, different loading patterns and structural analysis.
- To analyze the various modes of failure of machine components under different load patterns.
- To use design data books and different codes of design.

F Reference books and other reference materials:

1. Bhandari V. B., "Design of Machine Elements", Tata McGraw Hill Publishing Co.
2. George Dieter, "Engineering Design", McGraw-Hill Publishing, 4th Edition 2008.
3. Robert L. Mott, "Machine Elements in Mechanical Design", Prentice Hall, 4th Edition.
4. Robert C. Juvinalland Kurt M. Marshek, "Fundamentals of Machine Component Design", Wiley Publication.
5. Robert L. Norton "Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines", Tata McGraw Hill Publishing Co.
6. Burr and Cheathaam, Mechanical analysis and design.
7. G.M. Maitra, Handbook of Gear design. vol –I and II

8. W. D. Callister, Material Science.
9. Material handling equipment by Alexander
10. Material handling equipment by P. Rudenko.

G Reading Materials, web materials with full citations:

Web Materials:

1. ASME Journal of Mechanical Design (http://asmedl.aip.org/MechanicalDesign)

Other Materials:

1. Ramesh K, IIT Madras India, E-book on Engineering Fracture Mechanics.
2. PSG Design Data Book
3. Abdulla Shariff, Hand Book of Properties of Engineering Materials and Design Data for Machine, Elements

ME – 473 COMPOSITE MATERIALS

7th Semester and 4th Year

Program Elective - III

Credit and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	0	3	3
Marks	100	0	100	

A Objective of the Course:

- To help students to learn and identify fundamentals of Composite materials such as Polymer and metal matrix composites, fiber reinforced polymers and metals and nonocomposites.
- To make students understand the various fabrication methods used for composite materials.
- To understand various properties such as mechanical, thermal, electrical and tribological.
- To familiarize students concerning recent applications of advanced composites and nano composite materials.

B Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction to Composite materials	07
2.	Polymer matrix Composite Materials	11
3.	Metal matrix Composite Materials	09
4.	Ceramic Matrix Composite Materials	07
5.	Advances in Composite Materials	05
6.	Recent applications of Composite materials	06

Total hours (Theory): 45

Total hours (Practical): 00

Total hours: 45

C Detailed Syllabus:

1 Introduction to Composite materials **07 Hours 16%**

1.1 Fundamentals of composites and need for composites, Enhancement of properties of polymers and metals, Rule of mixture for composite materials

Classification of composites: – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites; Reinforcements – Particle reinforced composites, Fibre reinforced composites. Laminar composites

2	**Polymer matrix Composite (PMC) Materials**	**11 Hours**	**24%**
2.1	Polymer matrix resins – Thermosetting resins and thermoplastic resins Reinforcement:- Particulate reinforcements for polymers, Natural fibres, Synthetic fibres, other types of fibres Fiber Architectures: Rovings – Woven fabrics – Non woven random mats,		
2.2	PMC processes - Hand lay-up processes, Spray up processes, Compression moulding, Reinforced reaction injection moulding, Resin transfer moulding, Pultrusion, Filament Winding, Injection moulding.		
2.3	Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).		
3	**Metal matrix Composite (MMC) Materials**	**09 Hours**	**20%**
3.1	Characteristics of MMC, Various types of Metal matrix composites vs Alloy.		
3.2	MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements: different types of particles and fibres Effect of reinforcement: Volume fraction and weight fraction		
3.3	Processing of MMC: Powder metallurgy process, diffusion bonding, stirs casting, squeeze casting.		
4.	**Ceramic Matrix Composites**	**07 Hours**	**16%**
	Ceramics as Matrix systems, types of reinforcements Processing of ceramic matrix composites – powder method, CVD-CVI, PP route Properties and applications of Ceramics matrix composites		
5	**Advances in Composite Materials**	**05 Hours**	**11%**
5.1	Carbon / carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. High temperature treatment of Carbon / Carbon composites.		
6	**Recent applications of Composite materials**	**06 Hours**	**13%**
6.1	Current applications of composites in field of Civil constructions of structures/pannels,		

Aerospace industries, Automobile and other surface transport industries, Packaging industries, House hold, sports components and high end application, etc.

D Instructional Methods and Pedagogy:

- Lectures will be conducted with the aid of Multi-Media projector, Black Board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.
- Material testing laboratories visits will be organized for students to explore the facilities. Students are required to prepare a report on visit and submit as a part of the assignment.

E Student Learning Outcomes:

- Students will be familiar with the basic concepts of composite materials, matrix systems and reinforcing materials.
- Students will gain knowledge of processing techniques used for fabrication of composite materials.
- Students will be acquainted with the change taking place in various properties such as mechanical, thermal electrical and tribological in pure matrix and composite materials.
- Students will be aware of modern applications of composites and nano composites.

F Reference books and other reference materials:

1. Alma Hodzic and Robert Shanks, "Natural fibre composites: Materials, processes and properties", Woodhead Publishing, UK (2014)
2. Deborah D. L. Chung, "Composite Materials: Science and Applications", Second Edition, Springer (2009)
3. F. C. Campbell, "Manufacturing Processes For Advanced Composites", ELSEVIER (2004)
4. Kamal K. Kar, Jitendra K. Pandey, Sravendra Rana, "Handbook of Polymer Nanocomposites: Processing, Performance and Application, Volume-B", Springer (2015)
5. Sanjay K. Mazumdar, "Composites Manufacturing", CRC Press, (2002)
6. E. Fitzer· I. M. Manocha, "Carbon Reinforcements and Carbon/Carbon Composites", Springer-

Verlag Berlin Heidelberg GmbH, (1997)

7. S.T. Peters, “Handbook of Composites” Second Edition, Springer- Science & Business Media, (1998)

8. Nikhilesh Chawla & Krishan K. Chawla, “Metal Matrix Composites”, Springer- Science & Business Media, (2006)

G Reading Materials, web materials with full citations:

1. H. Ku , H. Wang, “A review on the tensile properties of natural fiber reinforced polymer composites”, Composites: Part B (2011), 42, 856–873

2. Georgios Koronis, “Green composites: A review of adequate materials for automotive applications”, Composites: Part B (2013), 44, 120–127

3. K. Suryanarayanan, “Silicon Carbide Reinforced Aluminium Metal Matrix Composites for Aerospace Applications: A Literature Review”, International Journal of Innovative Research in Science, Engineering and Technology, (2013), 2:11, 6336-44

4. I. A. Ibrahim, “Particulate reinforced metal matrix composites - a review”, JOURNAL OF MATERIALS SCIENCE (1991), 26, 1137-1156

5. A. Sommers, “Ceramics and ceramic matrix composites for heat exchangers in advanced thermal systems-A review”, Applied Thermal Engineering (2010), 30, 1277-1291

6. Farzana Hussain, “Review article: Polymer-matrix Nanocomposites, Processing, Manufacturing, and Application: An Overview”, Journal of COMPOSITE MATERIALS, (2006), 40:17, 1511-1575

ME 474: THERMAL SYSTEM DESIGN

7^{th} Semester and 4^{th} Year

Program Elective - III

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	0	3	3
Marks	100	00	100	

A. Objective of the Course:

- To learn the design process of Solar thermal system
- To study the design method for wind energy system.
- To explore the design of biogas plant.
- To learn about hybrid non- conventional systems.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Design of Solar Thermal System	20
2.	Design of Wind Energy System	15
3.	Design of Biogas Plant	05
4.	Hybrid system	05

Total Hours (Theory): 45

Total Hours (Lab): 00

Total Hours: 45

C. Detailed Syllabus:

1. Design of Solar Thermal System 20 Hours 45%

1.1 Solar Radiation , Solar economics, Photovoltaic, Flat Plate Solar Collectors, Passive Solar Heating Systems, Active Solar Heating Systems, Solar Hot Water Systems..

1.2 Solar PV system Design.

2 Design of Wind Energy System — 15 Hours 33%

2.1 Wind data and energy estimation – Wind energy Conversion systems – Wind energy generators and performance estimation of Wind Turbine power rating.

3 Design of Biogas Plant — 05 Hours 11%

3.1 Introduction to biomass, Bio-gas as a source of energy, types of Biogas plant.

3.2 Design of Biogas plant

4 Hybrid System — 05 Hours 11%

PV/Solar thermal/grid-connected hybrid System, Biomass-PV-Diesel Hybrid System, Solar wind hybrid system

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behaviour will be observed strictly.

E. Students Learning Outcomes:

At the end of the syllabus students will be able to:

1. Design various solar thermal systems.
2. Compare the performance of different solar collectors.
3. Estimate Wind Turbine power rating.
4. Design Bio-gas plant.
5. Understand different hybrid system.

F. Recommended Study Material:

Text Books/Reference Books:

1. Domkundwar & Domkundwar "Solar Energy and Non-Conventional Energy sources", Dhanpat Rai & Co., 2014.
2. Sukatame , "Solar Energy:, Tata McGraw Hill, New Delhi.
3. G. D. Rai, "Energy Sources" 2nd Ed. by, Khanna Publications, New Delhi.
4. Rao & Parulaker "Energy Technology", Khanna Publishers

Reference Books:

1. Suneel Deambi, "Photovoltaic System Design: Procedures, Tools and Applications" CRC Press, 2016.
2. Mukund R. Patel , "Wind and Solar Power Systems: Design, Analysis, and Operation" CRC press, 2006.
3. Zhifeng Wang, "Design of Solar Thermal Power Plants", Elsevier Science & Technology, 2018.

Web Materials:

1. http://www.nptel.ac.in/

Other Materials:

1. www.sciencedirect.com
2. SADHNA (Engineering Science): http://www.ias.ac.in/sadhana/
3. IEEE: www.ieeexplore.ieee.org

ME – 475 PRODUCT DESIGN & VALUE ENGINEERING

7th Semester and 4th Year

Program Elective- III

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	03	00	03	03
Marks	100	00	100	

A. Objectives of the Course:

- To know the concept of Product design in a manufacturing industry.
- To get familiar with the loading and scheduling techniques of product manufacturing.
- To understand the impact of value engineering on a product.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Product Design Fundamentals.	03
2.	Product Development	08
3.	Sustainable product design	04
4.	Loading and scheduling	08
5.	Value Management	02
6.	Value engineering Methodology	10
7.	Promoting VE in Government and Industry	10

Total Hours (Theory): 45

Total Hours (Lab): 00

Total Hours: 45

C. Detailed Syllabus:

1	**Product Design Fundamentals**	03 Hours	07%
1.1	The Design Process.		
1.2	The Product concept.		
1.3	The Product Research		
2	**Product Devlopment**	08 Hours	18%
2.1	Principles of new product devlopment.		
2.2	Standardization, Simplification		
2.3	Product Life Cycle Management		
2.4	Principles of product styling		
2.5	Product Launch		
2.6	Virtual Product Manufacturing		
3	**Sustainable product design**	04 Hours	09%
3.1	History of sustainable design		
3.2	Material and processes		
3.3	Pleasant experiences of sustainable design		
4	Loading and scheduling	08 Hours	17%
4.1	Inputs of scheduling		
4.2	Gantt charts, Techniques of scheduling		
5	**Value Management**	02 Hours	05%
5.1	Value engineering concepts		
5.2	Evaluation of Ideas		
6	**Value engineering Methodology**	10 Hours	22%
6.1	Anatomy of the function		
6.2	Application of value engineering phases.		
6.3	Value engineering techniques.		
7	**Promoting VE in Government and Industry**	10 Hours	22%

7.1 Building and Using a VE Community of Practice.

7.2 VECP Approval.

7.3 VECP Settlement.

7.4 Softwares used in association with Value Engineering

7.5 Value Engineering role in product life cycle

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- In the lectures behaviour will be observed strictly.

E. Students Learning Outcomes:

On successful completion of the course, the student will be able to:

1. Understand the fact design of any product.
2. Know the impact of product development.
3. Study the different types sustainable options for design..
4. Identify the function of product or service.
5. Establish a worth for function of product.
6. Apply different various techniques in value Engineering.

F. Recommended Study Material:

Text Books:

1. Kumar Prashant, "Product Design: Creativity, Concepts and Usability", PHI Learning Pvt. Ltd. 2012, 2012.,
2. Anil Kumar Mukhopadhyaya Value Engineering Mastermind: From Concept to Value Engineering Certification SAGE Publications India, 2009.
3 R C Gupta A K Chitale Product design and manufacturing Phi Learning Pvt. Ltd., New Delhi 6^{TH} Edition, 2013

Reference Books:

1. Richard Morris, "The Fundamentals of Product Design", Bloomsbury Publishing NewYork, 2^{nd} Edition. 2017,

2. Jonathan Chapman, “Routledge Handbook of Sustainable Product Design”, Routledge, 2017
3. Karl T. Ulrich, “Product Design and Development”, Tata McGraw-Hill Education, 2003
4. Devdas Shetty, Product Design For Engineers “Cengage Learning, 2015
5. Mudge, Arther E. 1971, Value Engineering: A Systematic Approach, McGraw-hill: New York.
6. Alphonse Dell’Isola, “Value Engineering: Practical Applications for Design, Construction, Maintenance & Operations”, R S Means Co., 1997
7. Richard Park, “Value Engineering: A Plan for Invention”, St. Lucie Press, 1999.
8. Del L. Younker, “Value Engineering analysis and methodology”, Marcel Dekker Inc, New York, 2004.
9. Mike Baxter., “Product Design”, CRC Press, 1995

Web Material:

1. NPTEL COURSE .http://nptel.ac.in/courses/112104230/12

Other Material:

1. https://www.value-eng.org.
2. https:// www.invest-in.org.
3. https://www.sciencedirect.com(Journal of Product Innovation Management)
4. http://www.inderscience.com (International Journal of Product Development)

ME – 476 ROBOTICS

7th Semester and 4th Year

Program Elective- III

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	0	3	3
Marks	100	0	100	

A. Objectives of the Course:

- To help students to learn the applications of Robotics in Industries.
- To give students idea about principle and working of different configurations of Robot.
- To understand the methods of motion analysis of manipulators.
- To learn the applications of Artificial Intelligence Techniques to robots.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Fundamentals of Robotics	03
2.	Components of Robot System	10
3.	Sensors and Actuators	06
4.	Control of Robot Manipulator	04
5.	Robot Programming	04
6.	Robot Motion Analysis	14
7.	Robotics and AI	04

Total Hours (Theory): 45

Total Hours: 45

C. Detailed Syllabus:

1 Fundamentals of Robotics **03 Hours 07%**

1.1 Introduction, automation and robotics, history of robotics, Advantages and disadvantages

1.2 Robot Applications in Manufacturing

2	**Components of Robot System**	**10 Hours**	**23%**
2.1	Anatomy of robot, classification of robot, robot configurations,		
2.2	Robotic systems, robot specifications, performance parameters, robot drive systems,		
2.3	Wrist and motions, Robot end effectors, force analysis of gripper mechanisms, Gripper design considerations, selection consideration of grippers		
3	**Sensors and Actuators**	**06 Hours**	**13%**
3.1	Introduction, classification of sensors and their functions, Position, velocity, acceleration sensors		
3.2	Proximity and range sensors, Touch and slip sensors, force and Torque sensors		
3.3	Actuators: Hydraulic, Pneumatic and Electrical actuators		
3.4	Stepper motors, AC and DC Servo motors		
4	**Control of Robot Manipulator**	**04 Hours**	**09%**
4.1	Robot control system and components		
4.2	Control of robotic joints		
4.3	Feedback control system		
5	**Robot Programming**	**04 Hours**	**09%**
5.1	Introduction, methods of programming, Motion interpolations		
5.2	Robot programming languages -features and applications		
6	**Robot Motion Analysis**	**14 Hours**	**30%**
6.1	Introduction to manipulator kinematics, Homogeneous transformation and robot kinematics		
6.2	Manipulator parameters, The D-H representation, Kinematics arm equations, inverse kinematics problems		
6.3	Robot arm dynamics, dynamics equations, Trajectory planning		
7	**Robotics and Artificial Intelligence**	**04 Hours**	**09%**
7.1	Applications of artificial intelligence in robotics		
7.2	Introduction to AI Techniques like Neural Networks, Soft Computing, Expert Systems, Genetic Algorithm and Fuzzy Logic		

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

On successful completion of this course, the student will be able to:

1. Understand fundamental of robotics and different component of robot.
2. Understand working of sensors and actuators and its application in robotics.
3. Describe different types of control use in robot design, including open loop and closed loop control system.
4. Know different programming language used to control robots.
5. Analyze robotic motion by solving kinematics and dynamics of robot arm manipulator with theory and some software.
6. Understand the use of Artificial Intelligence in robotics application

F. Recommended Study Material:

Text Books:

1. Klafter R. D., Chmielewski T. A. and Negin M., “Robot Engineering: An Integrated approach”, Prentice Hall of India, New Delhi.
2. Groover Z., “CAD/CAM: computer-aided design and manufacturing”, Prentice Hall of India, New Delhi.
3. Groover M. P., “Industrial robotics Technology, programming and applications”, McGraw-Hill Book Co.

Reference Books:

1. 13) Shahinpoor M., "A Robot Engineering text book", Harper and Row Publishers, NY.
2. Schilling R. J., "Fundamentals of Robotics, Analysis and Control", Prentice Hall of India.
3. Craig J. J., "Introduction to Robotics, Mechanics and control", 2nd Edition Addison – Wesley.

Web Material:

1. http://nptel.iitm.ac.in/

Other Material:

1. Production Engg. (Inst. of Engineers) http://www.ieindia.org/publish/pr/pr.htm
   Mechanical Engg. (Inst. of Engineers) http://www.ieindia.org/publish/mc/mc.htm
2. Journal of Robotics and Automation (IEEE) http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=56
   Sadhna (http://www.ias.ac.in/sadhana/)
   IEEE Transactions on Automation Science and Engineering (http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8856)
3. IET Control and Automation
   (http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=4469873)

ME – 477 OPTIMIZATION TECHNIQUES

8th Semester and 4th Year

Program Elective- IV

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objectives of the Course:

- To learn the applications of optimization techniques for engineering problems.
- To give exposure to classical techniques of Optimization.
- To give exposure to unconstrained non-linear programming techniques of optimization.
- To demonstrate the use of programming in solving the optimization problems.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction to Optimization	05
2.	Classical Optimization Techniques	15
3.	Non-Linear Programming: Unconstrained Optimization Techniques	25

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1. Introduction to Optimization **05 Hours 11%**

1.1 Introduction

1.2 Classification of Optimization problems

1.3 Statement of an optimization problem, design vector, design constraints, constraint surfaces, objective function & surfaces

1.4 Requirements for the application of Optimization methods

1.5 Applications of Optimization in engineering

2. Classical Optimization Techniques 15 Hours 33%

2.1 Introduction, Single-Variable Optimization

2.2 Multivariable Optimization with No Constraints, Saddle Point

2.3 Equality & Inequality Constrained Problems: Method of Lagrange Multipliers, Kuhn-Tucker Conditions

3. Non-Linear Programming: Unconstrained Optimization Techniques 25 Hours 56%

3.1 Unimodal function

3.2 Functions of Single Variable:

Elimination methods like Unrestricted Search, Exhaustive Search, Dichotomous Search, Interval-halving Method, Fibonacci Method and Golden-section Method

Interpolation Methods, Direct Root Methods like Newton Method, Quasi-Newton Method and Secant Method

3.3 Functions of Several Variables: Direct Search Methods, Gradient-based Methods and Numerical Methods

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject, course outcomes, learning outcomes will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

1. At the end of the course, students will learn various classical optimization techniques and their applications in engineering.
2. Students will learn to develop optimization models for various engineering problems.
3. Students will understand the mathematical tools that are needed to solve optimization problems.
4. Students can use mathematical software to solve the optimization problems.

F. Recommended Study Material:

Text Books:

1. Rao Singeresu S, "Engineering Optimization: Theory and Practice", New Age Intl. Ltd., Publishers.
2. Deb Kalyanamoy, "Optimization for Engineering design: algorithms and Examples", Prentice Hall of India.
3. Reklaitis G V, Ravindran A and Ragsdell K M, "Engineering Optimization: Methods and Application", Wiley.

Reference Books:

1. Arora J. S., "Introduction to Optimum Design", Elsevier.
2. Unwubolu Godfrey C. and Babu B. V., "New Optimization Techniques in Engineering", Springer.
3. Dennis J. Jr and Schnabel R., "Numerical Methods for Unconstrained Optimization and Nonlinear Equations", Society for Industrial and Applied Mathematics.
4. Fox R. L., "Optimization Methods for Engineering Design", Addison Wesley.

Web Material:

1. http://nptel.iitm.ac.in

Other Material:

1. Programming Languages: MATLAB
2. Science Direct Journal (http://www.sciencedirect.com)
3. IEEE transactions (http://ieeexplore.ieee.org)
4. Mechanical Engg. (Inst. of Engineers) http://www.ieindia.org/publish/mc/mc.html
5. Production Engg. (Inst. of Engineers) http://www.ieindia.org/publish/pr/pr.html

ME – 478 INDUSTRIAL TRIBOLOGY

8th Semester and 4th Year

Program Elective- IV

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. **Objectives of the Course:**

- To elucidate the processes of lubrication in all regimes.
- To teach the different wear processes in contacts
- To realize the friction phenomena in various machineries.
- To teach the students how to select suitable lubricant for a specific industrial application.
- To address the underlying concepts, methods and application of Industrial Tribology.
- To develop a solution oriented approach by in depth knowledge of Industrial Tribology.
- To understand the importance for selecting a suitable material combination for tribological contacts applications.

B. **Outline of the Course:**

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction to Tribology	05
2.	Friction	10
3.	Wear	10
4.	Lubrication and Lubricants	15
5.	Application of Tribology	05

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1	**Introduction to Tribology**	**05 Hours**	**11%**
1.1	Introduction to tribology		
1.2	History of tribology		
1.3	Interdisciplinary Approach		
1.4	Economic Benefits		
2	**Friction**	**10 Hours**	**22%**
2.1	Introduction to friction, Laws of friction, Causes of friction, theories of friction and measurements of friction.		
3	**Wear**	**10 Hours**	**22%**
3.1	Classification and Mechanisms of Wear, factor affecting of wear		
3.2	Theories of wear and measurements of wear		
3.3	Wear control mechanism methods		
4	**Lubrication and Lubricants**	**15 Hours**	**34%**
4.1	Importance of Lubrication, Boundary Lubrication, Mixed Lubrication, Full Fluid Film Lubrication; Hydrodynamic, Elastohydrodynamic lubrication, Types & Properties of Lubricants, Lubricants Additives.		
5	**Application of Tribology**	**05 Hours**	**11%**
5.1	Introduction, Rolling Contact Bearings, Gears, Journal Bearings - Finite Bearings.		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

- In the lectures and laboratory discipline and behavior will be observed strictly.

E. **Students Learning Outcomes:**

On successful completion of this course, the student will be able to:

- Students will be able to select compatible materials for minimizing friction and wear in machineries.
- Students will be able to select bearing and bearing arrangement in machines.
- Students will be able to apply fundamental principles of high contact stresses (Hertz stresses), fatigue-failure, and elastohydrodynamic (EHD) lubrication.
- The student can identify different areas of Industrial Tribology.
- Can find the applications of all the areas in day to day life.

F. **Recommended Study Material:**

Text Books:

1. Phakatkar H.G., Ghorpade R.R., "Tribology",Nirali Prakashan
2. Basu S.K., Sengupta S. N. , "Fundamental of Tribology" , PHI Learing Private Ltd.

Reference Books:

1. Sahoo Prasanta , "Engineering Tribology", PHI Learning Pvt. Ltd
2. Srivatsava Sushil Kumar,"Tribology in Industry", S. Chand andCo.
3. Tribological Design Data Guide, Part 1: Lubrication, 1995, The Institution of Mechanical Engineers, Tribology Group, UK.
4. Tribological Design Data Guide, Part 2: Lubrication, 1995, The Institution of Mechanical Engineers, Tribology Group, UK.
5. Cameron A, "Basic Lubrication Theory", Longmans, 1971,
6. Hutchings I. M., "Tribology: Friction and Wear of Engineering Materials", Edward Arnold Ltd, 1992.
7. Neale M.J., "Bearings: A Tribology Handbook", Butterworth Heinemann, 1993.
8. Szeri A., "Tribology", McGraw Hill Co., 1980, Taylor and Francis (reprint).
9. Williams J.A., "Engineering Tribology", Oxford University Press, New York, 1994.

Other Materials:

1. www.tribology-abc.com.
2. www.ltu.se/tfm/me.
3. www.skf.com.

4. www.statoillubricants.com
5. www.stle.org
6. www.imperial.ac.uk/tribology
7. http://rotorlab.tamu.edu/me626
8. Journal of Tribology, American Society of Mechanical Engineers.
9. Journal of Engineering Tribology, Mechanical Engineering Publications

ME – 479 SURFACE ENGINEERING

8th Semester and 4th Year

Program Elective- IV

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objectives of the Course:

- To make student familiar with the importance and applications of surface engineering.
- To make students aware about different methods for surface preparation.
- To make student understand various surface deposition techniques.
- To make students aware of various characterization methods of coatings.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Surface engineering	05
2.	Surface preparation	10
3.	Surface deposition techniques	15
4.	Characterization of coatings and surfaces	08
5.	Functional coatings and applications	07

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1	Surface engineering	05 Hours	11%

1.1 Introduction to surface engineering and its terminology, classification of surface engineering processes, microstructure and properties.

1.2 Current applications of surface engineering, frontier areas for applications of surface engineering, selection criteria for surface engineering processes.

2	**Surface preparation**	**10 Hours**	**22%**

2.1 Introduction to surface preparation, external cleaning methods such as gross cleaning, specific cleaning and by applications of fluids.

2.2 Rinsing, drying, outgassing and outdiffusion.

2.3 Evaluating and monitoring of cleaning by various cleaning tests.

2.4 In situ cleaning, recontamination of surfaces in the ambient environment and in deposition systems.

3	**Surface deposition techniques**	**15 Hours**	**34%**

3.1 Introduction to Physical Vapor Deposition (PVD) processes, various types of PVD processes.

3.2 Evaporation process and apparatus, evaporation sources, thermal evaporation, electron beam evaporation.

3.3 Molecular Beam Epitaxy (MBE), ion plating, Pulsed Laser Deposition (PLD), Atomic Layer Deposition (ALD).

3.4 Introduction to Chemical Vapor Deposition (CVD) processes, important reaction zones in CVD, Classifications of CVD reactions, components of CVD systems, Types of CVD processes.

4	**Characterization of coatings and surfaces**	**08 Hours**	**17%**

4.1 Measurement of coatings thickness, Surface roughness, Surface microscopy and topography, Atomic force microscopy (AFM), scanning electron microscope (SEM).

5	**Functional Coatings and Applications**	**07 Hours**	**16%**

5.1 Functional and nano-structured coatings and their applications in photovoltaics, bio- and chemical sensors. Surface passivation of semiconductors & effect on electrical properties. Surface engineering of polymers and composites. Thin film technology for multilayers &

superlattices for electronic, optical and magnetic devices

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of Multi-Media projector, Black Board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.
- Industrial visits will be organized for students to explore industrial facilities. Students are required to prepare a report on industrial visit and submit as a part of the assignment.

E. Students Learning Outcomes:

On successful completion of this course, the student will be able to:

- At the end of the course students will be able to understand the frontier areas for applications of surface engineering.
- They will know about various substrate surfaces and the selection criteria for surface engineering processes.
- They will be aware about different surface preparation and surface deposition processes.

F. Recommended Study Material:

Text Books/ Reference Books

1. P.M. Martin, "Handbook of Deposition Technologies for Films and Coatings: Science, Applications and Technology", Elsevier USA (2010).
2. M. Ohring, "The Materials Science of Thin Films", Academic Press Inc, San Diego, (1992).
3. D.M. Mattox, “Handbook of Physical Vapor Deposition (PVD) Processing, Film Formation, Adhesion, Surface Preparation and Contamination Control”, Noyes Publications U.S.A., (1998).
4. H.Y. Erbil, “Surface Chemistry of Solid and Liquid Interfaces”, Blackwell Publishing Ltd, UK, (2006).
5. Satyanarayana, V.N.T. Kuchibhatla, A.S.Karakoti, D. Bera, S. Seal, “One dimensional nanostructured materials”, Progress in Materials Science 52 699–913 (2007).

6. S.C. Tjong, H. Chen, “Nanocrystalline materials and coatings”, Materials Science and Engineering R 45 1–88 (2004).
7. B. Duncan, R. Mera, D. Leatherdale, M. Taylor, R. Musgrove, "Techniques for characterising the wetting, coating and spreading of adhesives on surfaces", NPL Report DEPC MPR 020 1-42 (2005
8. A.I. Gusev, A.A. Rempel, “Nanocrystalline Materials”, Cambridge International Science Publishing UK, (2004).
9. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications", Imperial College Press London, (2004).
10. B. Bhushan, “Springer Handbook of Nanotechnology”, Springer Berlin Heidelberg New York USA, (2004).

Other Materials:

1. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Manuf%20Proc%20II/New_index1.html
2. http://www.sciencedirect.com/science/journal
3. http://www.ieindia.org/publish/pr/pr.htm
4. http://www.ieindia.info/public.asp/me/me.htm
5. http://www.ias.ac.in/sadhana

ME – 480 ADVANCED MANUFACTURING TECHNOLOGY

8th Semester and 4th Year

Program Elective- IV

Credit Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- To provide knowledge of various advanced machining process in terms of its process capability.
- To aware the students about various thin film deposition process to improve tribological properties.
- To provide a background for various processes of additive manufacturing.
- To provide a background of polymer composites and metal matrix composites.
- To aware the students about the application of various advanced metrology and characterization techniques.
- To aware the students about recent trends and digitalization in manufacturing.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Advanced Machining Processes	16
2.	Thin Film Coating and Deposition Processes	08
3.	Additive Manufacturing	05
4.	Composites Manufacturing	06
5.	Advanced Metrology and Material characterization techniques	06
6.	Digital Manufacturing	04

Total hours (Theory): 45

Total hours (Lab): 30

Total: 75

C. **Detailed Syllabus:**

1	**Advanced Machining Processes**	**16 hours**	**35%**
1.1	Mechanical energy based advanced machining processes like ultrasonic machining, abrasive jet machining-process parametric analysis, process capabilities, and applications.		
1.2	Thermoelectric based advanced machining processes like electro discharge machining, wire EDM, plasma arc machining, laser beam machining, focused ion beam machining-working principles, material removal mechanisms, process capabilities and applications.		
1.3	Electrochemical and chemical based machining-electrochemical machining, electrochemical grinding, chemical machining-process characteristics, applications and limitations.		
1.4	Hybrid processes abrasive water jet machining-abrasive flow finishing-magnetic abrasive finishing-magnetorheological finishing-ElectroSream drilling, shaped tube electrolytic machining- introduction, working principles, process performance, application.		
1.5	Micro and nano machining processes, advanced processes like explosive forming, water hammer forming etc.		
2	**Thin Film Coating and Deposition Processes**	**08 hours**	**18%**
2.1	Metal and inorganic material coatings.		
2.2	Vapor deposition processes like physical vapor deposition (PVD), chemical vapor deposition (CVD) and its variants.		
2.3	Molecular beam epitaxy (MBE), ion plating, pulsed laser Deposition (PLD), atomic layer deposition (ALD).		
2.4	Introduction to sputtering, generation of energetic particles, sputtering yield.		
2.5	Types of sputtering processes such as DC sputtering, RF sputtering, magnetron sputtering, reactive magnetron sputtering, target poisoning.		
3	**Additive Manufacturing (AM)**	**06 hours**	**13%**
3.1	Essentials of AM, AM process chains, AM data formats.		
3.2	Various types of AM systems i.e., Stereo lithography. FDM, SLS, SLA, LOM, RFP etc.		
3.3	Factors concerning to AM: consideration for adoptions, advantages, accuracy and economic consideration.		
4	**Composites Manufacturing**	**06 hours**	**13%**
4.1	Introduction to composites: function of the matrix and reinforcement in composites, fiber reinforcement.		
4.2	Various polymer composite manufacturing processes: lay-up processes, spray up process, fiber placement process, resin transfer moulding, vacuum assisted resin transfer moulding, compression molding process, filament winding, calendaring.		
4.3	Metal matrix composites, solid state processing, liquid state processing.		
5	**Material characterization techniques**	**05 hours**	**11%**

5.1 Fundamentals of light microscopy, SEM, AFM, XRD, DSC/TGA etc.

6	**Digital Manufacturing**	**04 hours**	**10%**

6.1 IOT based manufacturing, intelligent manufacturing and smart manufacturing.

6.2 Data analytics and decision making.

D. Instructional Methods and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi–media projector, black board, OHP etc.
- Attendance is compulsory in lectures.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- In the lectures discipline and behavior will be observed strictly.

E. Student Learning Outcomes / objectives:

On successful completion of the course, the student will be able to:

1. Identify the application areas of various advanced manufacturing processes.
2. Understand the principles of various thin film deposition techniques.
3. Explore advanced techniques of additive manufacturing like 3D printing.
4. Understand the importance of composites in current application areas.
5. Explore the uses of various material characterization techniques in manufacturing.
6. Understand the current trends in today's manufacturing systems.

F. Recommended Study Material:

Text Books/ Reference books:

1. Jain V. K., "Advanced Machining Processes", Allied Publishers, Mumbai
2. Benedict. G.F. "Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York
3. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi
4. Jain V. K., "Introduction to Micro machining", Narosa publication
5. P.M. Martin, "Handbook of Deposition Technologies for Films and Coatings: Science, Applications and Technology", Elsevier USA (2010)
6. M. Ohring, "The Materials Science of Thin Films", Academic Press Inc, San Diego, (1992)
7. Pham D.T. and Dimov S.S, "Rapid Manufacturing", Springer-Verlag, London, (2001)
8. Ghosh A., "Rapid Prototyping: A Brief Introduction", East West Press, (2003)
9. Raghavendra N. V., Krishnamurthy L., "Engineering Metrology and Measurements", Oxford University Press (2013)
10. Douglas B. Murphy," Fundamentals of light microscopy and electronic imaging", Wiley-Liss, Inc. USA, (2001)
11. Gilchrist A.,"Industry 4.0: The industrial internet of things", Apress, (2016)

12. Zude Z., Shane X., Dejun C. “Fundamentals of Digital Manufacturing Science”, Springer (2012)

Web materials:

1. http://nptel.ac.in/courses/112104028/

ME – 481 COMPUTATIONAL FLUID DYNAMICS

8th Semester and 4th Year

Program Elective- IV

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objective of the Course:

- To learn the computational approaches to study Fluid Mechanics and Het transfer problems.
- To introduce governing equations of viscous fluid flows
- To enable the students to understand the various discretization methods
- To learn analysis and design of thermal and fluid flow systems

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction	04
2.	Mathematical Behavior of Partial Differential Equations	04
3.	Finite Difference Technique	10
4.	Finite Element Method	10
5.	Finite Volume Method	06
6.	Numeric Grid Generation	06
7.	Navier-Stokes Equations	05

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1.	**Introduction**	**04 Hours**	**09%**
1.1	Introduction of CFD. Applications of CFD.		
1.2	Introduction of Software's for CFD.		
1.3	Conservation equation; mass; momentum and energy equations; convective forms of the equations and general description.		
2	**Mathematical Behavior of Partial Differential Equations**	**04 Hours**	**09%**
2.1	Introduction, Classification of quasi-linear partial differential equations.		
2.2	Impact of different classes of Partial differential equations (Hyperbolic, parabolic, elliptic equations) on CFD.		
3	**Numerical Techniques for Discretization**	**10 Hours**	**22%**
3.1	Introduction to Finite Differences, Taylor's expansion series, approximation techniques for first order derivative, second order derivative and mixed derivative for uniform and non-uniform grid, using forward difference scheme, backward difference scheme and central difference scheme, Steady state one-dimensional conduction equation.		
3.2	Discretization, Steady state one dimensional conduction and convection equation analytical solution and numerical solution using forward difference, backward difference and the central difference schemes		
3.3	Discretization of time dependent parameter using explicit scheme, implicit scheme, Discretization of governing equations, approximations in non-uniform grids, boundary conditions implementation, errors.		
4	**Finite Element Method**	**10 Hours**	**22%**
	Introduction to Finite Element Method: Basics of finite element method, stiffness matrix, isoperimetric elements, formulation of finite elements for one and two dimensional elements; applications.		
5	**Finite Volume Method**	**06 Hours**	**13%**
	Introduction to Finite Volume Method: Integral approach, Discretization and higher order schemes, Application to Complex Geometry.		
6	**Numeric Grid Generation**	**06 Hours**	**13%**
	Numerical grid generation; basic ideas; transformation and mapping		
7	**Navier-Stokes Equations**	**05 Hours**	**10%**
	Explicit and implicit methods; SIMPLE type methods; fractional step methods.		

D. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. **Students Learning Outcomes:**

At the end of the syllabus students will be able to:

1. Understand various governing equations applicable for viscous fluid flows.
2. Understand the mathematical behavior of partial differential equations.
3. Apply Finite Difference Method Technique to one dimensional and two dimensional Engineering problems.
4. Apply various Finite Element Methods to one dimensional and two dimensional Engineering problems.
5. Understand the discretization by Finite Volume Method.
6. Understand the use commercial computational fluid dynamics software to simulate and analyze a wide range of fluid flows.
7. Analyze the fluid flows and Heat transfer problems using computational technique.

F. **Recommended Study Material:**

Text Books:Reference Books:

1. Patankar, "Numerical heat transfer and Fluid Flow", Mc.GrawHill. 2002.
2. John D Anderson Jr., "Computational Fluid Dynamics: The Basics with Applications", McGraw-Hill, 1995.
3. Chandrupatla and Belegundu, "Introduction to Finite Element Methods", Prentice Hall of India.
4. Peric and Ferziger, "Computational Methods for Fluid Dynamics", Springer

Publication.

5. Veersteeg and Malalasekara, "CFD: The Finite Volume Method by", Prentice Hall, 1996.

Reference Books:

1. Carnahan B, "Applied numerical method" John Wiley and Sons-2001.
2. Dante A W, "Introduction to Computational Fluid Dynamics", Cambrige Uni. Press, 2005.
3. Reddy J N and Gartling D K, "The Finite Element Method in Heat Transfer and Fluid Dynamics", CRC Press, 2000.
4. White F M, "Viscous Fluid Flow", Mc Graw Hill, 1991.
5. Schlichting H, Gersten K, "Boundary-Layer Theory", 8th edition, 2004.
6. Anderson, J D, "Modern Compressible Flow: With Historical Perspective", McGrawHill, 2002.
7. Murlidhar K and Sunderrajan T, "Computational Fluid Mechanics and Heat Transfer", Narosa Publishing House.
8. Goshdastidar, "Computer Simulation of Flow and Heat Transfer", Tata-McGraw Hill.

Web Materials:

1. http://www.nptel.iitm.ac.in/

Other Materials:

1. Programming Languages and Software's: ANSYS, COMSOL.
2. www.sciencedirect.com:

   International Journal of Heat and Fluid Flow.

   International Journal of Thermal Sciences.

   Experimental Thermal and Fluid Science.
3. SADHNA (Engineering Science): http://www.ias.ac.in/sadhana/
4. IEEE: www.ieeexplore.ieee.org

ME – 482 DYNAMICS OF COMPRESSIBLE FLOW

8th Semester and 4th Year

Program Elective- IV

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Objectives of the Course:

- To learn the basic relations for compressible flow analysis.
- To aware the student about wave phenomenon to study the behaviour of compressible flow.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Introduction	05
2.	Isentropic Flow with Variable Area	08
3.	Normal Shock Waves and Oblique Shock	08
4.	Flow in Constant Area Ducts with Friction	08
5.	Flow in Constant Area Ducts with Heat Transfer	06
6.	Study of Wind Tunnels	04
7.	Boundary Layer Flows	06

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

C. Detailed Syllabus:

1. Introduction **05 Hours 11%**

1.1 Thermodynamic concept, Types of flows, Concepts of continuum and control volume.

1.2 Generalized continuity, Momentum and Energy Equations.

1.3 Speed of sound wave, Mach number, Physical difference between incompressible, Subsonic and supersonic flows, three reference speeds, dimensionless velocity, concepts of static and stagnation parameters.

2	**Isentropic Flow with Variable Area**	**08 Hours**	**18%**
2.1	Concept of Isentropic and adiabatic processes. Mach Number variation, choking in isentropic flow.		
2.2	Operation of nozzles and diffusers under varying pressure ratios, performance of real nozzles, applications of isentropic flow.		
3	**Normal Shock Waves and Oblique Shock**	**08 Hours**	**18%**
3.1	Development of a shock wave, governing equations, Rankine – Huguenot, Prandtl and other relations, weak shocks, thickness of shocks, normal shocks in ducts.		
3.2	Performance of convergent–divergent nozzle with shocks, moving shock waves, shock problems in one dimensional supersonic diffuser, supersonic pitot tube.		
3.3	Introduction to oblique shock.		
4	**Flow in Constant Area Ducts with Friction**	**08 Hours**	**18%**
4.1	Fanno curves, Fanno flow equations and its solution, Fanno Flow tables.		
4.2	Variation of flow properties, performance of long ducts.		
4.3	Isothermal flow with friction.		
5	**Flow in Constant Area Ducts with Heat Transfer**	**06 Hours**	**13%**
5.1	Rayleigh line, Rayleigh flow relations, Tables for Rayleigh flow.		
5.2	Variation of flow properties, choking effects, shock waves with changes in stagnation temperature.		
6	**Study of Wind Tunnels**	**04 Hours**	**09%**
6.1	Types of wind tunnels		
6.2	Various flow visualization methods		
7	**Boundary Layer Flows**	**06 Hours**	**13%**
7.1	Introduction and Description of boundary layer flow, Boundary layer parameters, Boundary layer thickness, Displacement thickness, Momentum thickness, Energy thickness.		
7.2	Prandtl's boundary layer equation. Characteristic properties of Laminar Boundary Layer. Characteristic properties of Turbulent Boundary Layer.		

7.3 Separation of boundary Layer. Regimes of external flow-wakes and drag. Drag on immersed body, sphere, cylinder, bluff body, Lift and Magnus effect. Potential flow past a circular cylinder with circulation, doublet. Circulation around aero foil, Drag and Lift of an aero foil.

D. Instructional Method and Pedagogy:

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi–media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.
- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.
- Experiments/tutorials related to course content will be carried out in the laboratory.
- In the lectures and laboratory discipline and behavior will be observed strictly.

E. Students Learning Outcomes:

At the completion of the course, students will be able to

1. Understand the fundamentals and elements of compressible flows.
2. Apply the basic relations in thermodynamics and fluid mechanics required for compressible flow analysis and evaluate the one dimensional steady isentropic compressible flow through variable area duct.
3. Analyze one dimensional steady compressible flow through variable area duct with normal shock and oblique shock.
4. Evaluate one -dimensional steady compressible flow through a constant area duct with consideration of friction.
5. Evaluate one -dimensional steady compressible flow through a constant area duct with consideration of heat transfer.
6. Analyze Aerodynamics properties of various models with the help of wind tunnel and understand the type of compressible flow by using various flow visualization technics.

F. Recommended Study Material:

Text Books:

1. Yahya S. M., "Fundamentals of Compressible Flow", New AGE International Limited, 2012.

2. Anderson, J.D., “Modern Compressible Flow: With Historical Perspective”, McGraw Hill, 2003.
3. P. Balachandran , “Fundamentals of Compressible Fluid Dynamics”, PHI Learning Pvt. Ltd., 2006.
4. Kumar, D. S. “Fluid Mechanics and Fluid Power Engineering”, S. K. Kataria & Sons, 2008.

Reference Books:

1. Rathakrishnan. E, “Gas Dynamics”, Prentice, Hall of India Pvt. Ltd., 2008
2. Yahya. S. M., “Gas Tables for Compressible Flow Calculations” New AGE International Limited, 2006.
3. Robert D. Zucker and Oscar Biblarz “Fundamentals of Gas Dynamics” John Wiley & Sons, INC., 2002.
4. Shapiro A. H, “Dynamics and Thermodynamics of Compressible Fluid Flow, Vols. I and II”, Ronald Press, New York, 1953.

Web Material:

1. http://www.nptel.iitm.ac.in/

Other Material:

1. SADHNA (Engineering Science): http://www.ias.ac.in/sadhana/
2. www.sciencedirect.com (Experimental Thermal and Fluid Science, International Journal of Heat and Fluid Flow)