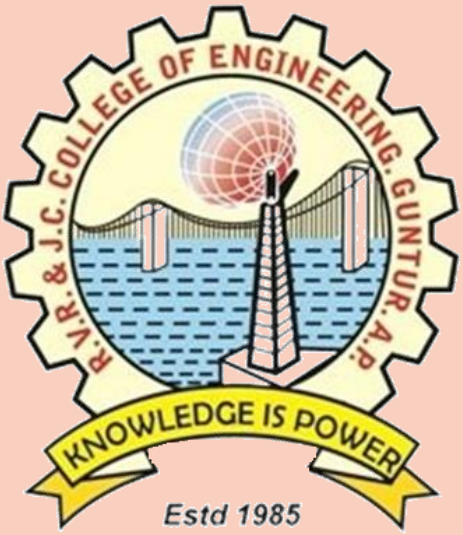
MECHANICAL ENGINEERING

Scheme of Instruction,
Examinations and Syllabi

[First Year & Second Year B.Tech. Degree, w.e.f. 2020-21]



R.V.R. & J. C. COLLEGE OF ENGINEERING
(Autonomous)
Accredited by NBA and NAAC with "A" Grade
Chandramouli Puram :: Chowdavaram :: GUNTUR – 522019.

THE INSTITUTION

Established in 1985, Rayapati Venkata Ranga Rao & Jagarlamudi Chandramouli College of Engineering, Guntur is the 'Jewel in the Crown' of Nagarjuna Education Society, which took upon itself the responsibility of enriching the society through promotion of education, literature and culture. As it always happens, the genuine intentions of the promoters of the society received the support of the Almighty. Today eight educational institutions are functioning under the banner and patronage of Nagarjuna Education Society, with R.V.R. & J.C. College of Engineering, being the flag-ship of them, of course.

Vision:

To develop integrated manpower with right attitude, possessing knowledge and skills, required to make an honourable living and contribute to the socioeconomic development and welfare of the society.

Mission:

- To produce globally agile graduates with value orientation, professional competency, critical and creative thinking and lifelong learning.
- To enrich the society through education and research by generating proficient manpower, capable of contributing to the needs of the industry.
- To provide conducive learning environment, encompassing knowledge, communication and soft skills that enables the students to transform themselves into global leaders.

Values and Core Principles

The culture of an institution is a shared system of values, beliefs and attitudes that shapes and enhances behaviour. "The culture is determined through the organization from top to bottom and we must live our values to continuously improve." We define our organization culture broadly by six operating Core Principles that guide us.

1. **Student Focus** - The primary focus is not only to educate the students but to inspire them to become innovative and contribute to the society.
2. **Strengthen Faculty and Staff** - The faculty inspire us and direct all we do academically." The staff deliver the administrative services and partner with the faculty. "Newer inputs have to be added continuously to the capabilities of people.
3. **Foster Leadership and ethical decision making** - Leadership and ethical decision making are essential for the growth of the organization and individual.
4. **Committed to accountability and excellence** - If we are to remain relevant and attract the best of the students and faculty the culture of excellence shall pervade the whole institution both in academic and administrative areas.

5. **Focus on Resource Management** - The financial well-being of an institution is critical for its success. "We embrace responsibility-centred Management for improving our financial strength.
6. **Heighten Reputation** - All the units of the institution will gain in many ways through reputation and it is everyone's endeavour to add to the reputation.

While our strategy for action may not directly reflect our core principles, they invariably go into our basic planning & development processes.

Looking back through the 36 years of journey, there were moments of pride, the notable among them was Accreditation by NBA in 1998, 2002, 2007, 2012, and 2017. The institute applied for accreditation by NAAC in the year 2012 and got "A" grade in 2014 and applied for renewal of accreditation by NAAC in 2019; a high rating in Academic Audit & Grading conducted by A.P. State Council of Higher Education and a place among the Top- Engineering Colleges in national and state surveys and a consistent top position in university examination results. The institute is under NIRF rank band 201 - 250(for 2020) and ISO 9001:2015 certification from 2019.

It is our endeavour to improve continuously, with the suggestions of our academia, public, Alumni and students, without abandoning our culture and core principles.

COURSES OFFERED

1) Under-Graduate: B.Tech

i)	Civil Engineering (1985)	180
ii)	Mechanical Engineering (1985)	180
iii)	Electronics & Communication Engg. (1985)	180
iv)	Electrical & Electronics Engg. (1994)	180
v)	Computer Science & Engineering (1994)	180
vi)	Chemical Engineering (1996)	60
vii)	Information Technology (1998)	120
viii)	Computer Science & Business Systems (2019)	60

2) Post-Graduate:

i)	Management Sciences (MBA) (1995)	120
ii)	Computer Applications (MCA) (1995)	120
iii)	M.Tech in Computer Science & Engineering (2003)	25
vi)	M.Tech in Power Systems Engineering (2004)	18
v)	M.Tech. Structural Engineering (2004)	18
vi)	M.Tech in Communication Engineering and Signal Processing	18
vii)	M.Tech in Machine Design	18
Viii	M.Tech in Computer Science & Technology	18

The Campus

A built up area of 65,985 sq.m. on a 37.41 acres plot houses 61 Laboratories and 18 Computer Centres besides amenities like Canteen, Seminar Halls, Auditorium, Open Air Theatre, Gymnasium, e-classrooms and Conference Halls etc. to make life in the classroom and outside easy and comfortable. Continuous power supply is provided from 200 KVA, 250 KVA and 500 KVA modern Generator sets. Andhra Bank Branch is located in the campus. A fleet of 24 buses save the staff and students from the vagaries of public transport. The aesthetically designed structures, the hill slopes on the West, a well laid out campus dotted with roads, trees and gardens merge into a stunning landscape that inspires the minds to "Think Better, Work Better".The Work Culture

The Management and Staff are a group of uncompromising people who stretch beyond reasonable limits to attain their objective - Excellence in everything they do. The people of RVR & JC have learnt that meeting of the minds and joining hands is the easier wayto success. They do meet and interact frequently to set new starting lines than to celebrate the finishing lines reached.

The People

The College is possessive of its intellectual property; 257-strong faculties with diversityin specialization and heterogeneity in abilities have unity in their objective of enrichingthe students with up-to-date technical information, data and skills. The teachers adopt a very professional attitude and commitment in imparting instruction, counseling and personality development in which the student has the final say. The emphasis is moreon learning of the student than on teaching. All our teachers are rated 90% good by the students. The 165-odd administrative and supporting people provide the logistics to run academic and administrative operations, with silent efficiency.

Discipline

Insulating the students from the vulnerable influence due to the society's contemporary aberrations is our endeavor. The institution had become the choice of the parents for its track-record of campus discipline. The ambience and the exemplary orderliness ofbehavior of the staff induces a self-imposed discipline in the students. The temporary abnormalities if any, are disciplined, of course.

Computer Centers

The computer facilities are vast. About 1500 terminals with latest configuration are located in fourteen Central and Department Computer Centers, all air conditioned. Software necessary for effective training and instruction as well as for consultancy are in place. All the computers in the campus have been interconnected through campus-wide intranet using Fiber Optic cables and switches. The City Computer Centre is an off-time facility for students

& staff. Examination & administrative services are computerised. Currently, 16 MBPS Wireless Internet connectivity is provided by installing a Micro Tower.

Library

The four-storied library of 87,468 volumes of 25,910 titles, 3,267 CDs and educationalfilms is the biggest learning resource in the campus. 257 National and International Journals provide up-to-date information on any topic the students and staff look for. Orderly stacking, computerized information and the seven qualified library staff facilitate easy location of any information needed. The Digital Library is providinginternet facility to all the students with 17 systems. Comfortable seating arrangement and large reading spaces provide a serene atmosphere for spending long hours in the library. The City Centre too has a reference library that is open upto 10.00 p.m.

Hostels

Four storied Girls hostel with a 6,040 sq.m. accommodating 650 girl students with modern facilities available. Four storied boys hostels with a 11,152 sq.m. accommodating 1400 students with modern facilities in the College campus.

The Students

From the day of induction, the staff do everything to naturalize the students to the culture of R.V.R. & J.C. College of Engineering i.e. single minded pursuit of the objective. The part played by the students in making the College, into an ideal seat of learning is significant. The students of this College consistently produce the best of the results in the University.

Extra-curricular Activities

NCC, NSS Units are established in the College. Opportunities are a plenty for those with extracurricular talent. Numerous competitions are held for various levels of students, who have proved their superiority in various inter-collegiate competitions conducted by public organizations and other institutions. The students prove their leadership qualities and co-operative skills by organizing colorful functions at regular intervals.

Campus Recruitment

About 50 renowned Industries / IT Organizations regularly visit the College to recruit the final years for employment. A training and placement Department monitors recruitment, short term training and personality development programmes. During the last four years the Campus recruitment steadily grew up to 950+ in 2019-20.

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DEPARTMENT OF MECHANICAL ENGINEERING

VISION

"Envisions to be a 'Centre of Excellence' by synergizing quality education with professional and human values, and to instill a broader sense of social responsibility".

MISSION

To provide quality education to the students with the fundamental background necessary for an active successful professional career in Mechanical Engineering in general, to impart knowledge and enlighten students to make them competent, self-motivated and expanding their knowledge skills through continuous education, and toinculcate human values and concern for environment and the society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1: Contribute directly to professional careers with strong framework to apply principles of Mathematics, Basic Sciences and Engineering.

PEO2: Empower people to better understand and engage in real time, engineering problems to design, build, analyze and realize the physical systems and components or processes using professional knowledge and skills resulting in significant societal benefit.

PEO3: Strive to achieve potential and expand their capabilities through harnessing multi-disciplinary skills and to analyze engineering issues in a broader perspective with ethical responsibility towards sustainable development.

PEO4: Enhance knowledge and skills in the areas of interpersonal activities, leadership and team building to achieve organization goals and pursue lifelong learning and higher education necessary to extend the reach and amplify the voice of successful profession.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1: Ability to gain expertise in identifying the problem and utilizing the computational tools to formulate & solve real-world problems in the areas of Design Engineering, Thermal Engineering, Material Science, Manufacturing Technology, and Industrial Management, which in turn build careers as entrepreneurs and technocrats.

PSO2: Able to apply advanced technology & software tools in research & development of new & cost effective systems in the areas of Mechanical Engineering & Interdisciplinary Fields.

PROGRAMME OUTCOMES (POs):

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering

problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including predication and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.

DEPARTMENT PROFILE:

The Department was established in **1985**. It started an U.G. course in Mechanical Engineering in the same year. This course had been accredited by N.B.A. and awarded 'A' Grade for three years in May, 1999, 'A' Grade for five years in May, 2002, 'A' Grade for three years in September, 2007, in July, 2012 , in September, 2017 and for the Sixth time in June, 2021. The Institution was Accredited by NAAC with "A" grade IN 2014 and with A+ grade in 2021.The Department was well established and running successfully with an intake of 120 Students in B.Tech programme & 6 students in M.Tech (Machine Design) programme and Ph.D Scholars are being guided by our faculty members.

Mechanical Engineering plays a major role in structuring the real world, which is a challenging discipline. Mechanical Engineers design, manufacture and maintain machinery used by all disciplines of engineering. This discipline has attracted outstanding individuals and helped in addressing the crucial technical challenges in the contemporary world. The career path of a mechanical engineer is largely determined by individual choice-a unique advantage in an ever-changing competitive world. It encompasses all important aspects of

Modern Technology. In Automotive, Paper, Aerospace, Petrochemical, Automation, Robotic, Refrigeration and Air Conditioning Industries and Nanotechnology, Mechanical Engineers have been playing a leading role. Mechanical and Thermal Design of Computers and other Electronic Equipment is carried out by Mechanical Engineers. To summarize, the versatility, wide-ranging scope and universal relevance of mechanical engineering opens up career avenues in all possible branches of the engineering profession.

Development of ANSYS, Pro-Engineer, Master CAM, AutoCAD packages, Mechanical Desktop, Edge CAM etc., revolutionized the way Mechanical Engineers tackle the problems. Forecasting of the failure, Diagnostics of Breakdowns, Quality Circles, Optimization of Machine elements, Preparation of New Models have become the order of the day for budding Mechanical Engineers. In the early days of the profession, Most of the work of Mechanical Engineers consisted of Design & Manufacture. Now Mechanical Engineers need to know a lot of Principles from other disciplines of Engineering to stay ahead. Guest Lectures and Industrial visits are arranged for Shop floor experience and inplant Training.

The Department has well established laboratories and students learn the concepts through Experienced and well trained Faculty. Several computing environments are available for their study and use computers are also an added advantage for problem solving in many Mechanical Engineering courses. As science and Engineering are rapidly changing and advancing, the courses offered by the Department take care of the needs of Prospective Mechanical Engineers. Mechanical Engineering curriculum covers the following areas:

Mechanical Design
Thermal Sciences
Dynamics, Vibration & Controls
Materials and Manufacturing Technologies
Mechatronics

People:

The Department has 9 Professors all with Doctorate, 13 Associate Professors all with Doctorate. 19 Assistant Professors with Three doctorates. The entire faculty has Post-Graduate Degree in Mechanical Engineering with various specializations to provide in-depth Theoretical and Practical knowledge in all disciplines. All the faculty are research oriented and two of them were submitted thesis for Ph.D. Four staff members are in an advanced stage of research for their Ph.D. The doctorate holders of the department are acting as research supervises under Acharya Nagarjuna University, SV University, JNTUK...Etc. and guiding many scholars. The faculty are also the members of various professional societies at national and international level.From last 10 years 541 Research Papers were published by the Faculty in SCI, Scopus Indexed, UGC Recognized International Journals etc., till date.

All the staff are passionate and dedicated towards teaching and have the welfare and prospect of the students as their main interest. Many of the staff have produced 100% result in the subjects taught by them for the last few years. The general feedback from the students on the Faculty is very good.

The Department regularly organizes various faculty development programs to update the knowledge of faculty. Most of the faculty development programs got financial support from AICTE, UGC, DST. Our management is also give support to enrich the knowledge and to get familiar with the latest advancements.

Department's highly skilled and motivated Technicians have fabricated a number of Test-Rigs for regular laboratory work. They have done innovative projects for which APCOST and the Management of the College awarded grants and funds. Our Technicians always lend a helping hand to the final year students of all Branches in fabricating and completing their project works.

Laboratory Facilities:

The Department has sprawling Workshops, where Carpentry, Tin smithy, Welding and House Wiring are taught to students of all branches of First Year. Thermal Sciences laboratory has equipment and test-rigs pertaining to IC Engines, Fuels and Lubricants, Air Compressors, Heat Transfer, Refrigeration and Air Conditioning and Automobiles. Experiments to study fundamentals and vibrations of linkages, constructional features and effect of vibration on the life of machinery are carried out in Kinematics and Vibration laboratory, Machine shop, CAD/CAM Laboratory, Metrology Laboratory and Industrial Engineering Laboratory.

The Department's pride is the CAD/CAM Laboratory in which Rs.27 Lakhs from projects sanctioned by AICTE, New Delhi were invested. The laboratory boasts of 110 computer systems with Core i3, a server and latest and advanced Software like AutoCAD, Mechanical Desktop, CATIA, MSC Nastran, Autodesk Inventor, CAEFEM, ANSYS, Pro E. The Department was awarded a MODROB's project by AICTE with a sanction of an amount of Rs.12 Lakhs to establish Mechatronics Laboratory for B.Tech and M.Tech students. The laboratory consists of Mechatronics equipment, which enable the students to learn principles of equipment and simulation software.

Research, Consultancy and Continuing Education:

A total of Rs 2,14,27,366/- have been received by the department for research activities, upgradation of various laboratories and computer systems from funding agencies like AICTE, UGC, APCOST, NEDCAP etc. At present, 9 Research Projects (awarded 7 by Industry, 1 by AICTE & 1 by DST) are ongoing worth Rs.1,03,35,566/- lakhs. It is also not an out of place to mention that the department has a Research Centre approved by Acharya Nagarjuna University.

Facilities exist for consultancy work in Research Centre equipped with Ball Mill, Pin on Disc Wear Testing Machine, Micro Hardness Tester, Analysis & Modelling Softwares, CMM, Electric Furnace, Metallurgical Microscope etc., to do research in Composites. These facilities are extended to the Research Scholars, P.G students of other nearby institutions and thereby generating Consultancy.

All the staff members of the department regularly update their knowledge in the latest technologies by attending continuing education programmes organized by reputed institutions and also the department organizes minimum 1 to 2 Faculty Development Programmes every year by providing the platform by sharing the knowledge of Industrial / Academia experts and our own Senior faculty to the participants.

Skill Development Centre:

Andhra Pradesh State Skill Development Corporation (APSSDC) has established Six Skill Development Centres in our institution, through which, our students getting trained in IC

Engines Two Wheeler Assembly, Three Wheeler Assembly, R&AC, Agricultural Farming Machinery, Electrical Wiring& Computer based training labs. These facilities are also extended to the students other nearby Technical Institutions. Also Dassault Systems has established 3D studio Lab to train the Mechanical Engineering students on latest modules and Certification programmes were also introduced in our campus, which enables the students to industry viable.

Applied Robotics Control lab was established in association with European Centre for Mechatronics, Achen, Germany and APSSDC.

Training & Placement(s):

The Department is even doing well in placements. Almost 90% eligible students got placed into Core as well as Software companies. The major recruiters are TCS, CTS, INFOSYS, CUMMINS, TECH MAHINDRA, HEXAGON, SATVEN, HYUNDAI, Mahindra SATYAM and many more. The department organizes many training programs for the benefit of students to improve the skills and knowledge in association with Training & Placement Cell.

Extra-curricular Activities:

NCC, NSS Units established in the College. Opportunities are a plenty for those with extracurricular talent. Numerous competitions are held for various levels of students, who have proved their superiority in various inter-collegiate competitions conducted by public organizations and other institutions. The students prove their leadership qualities and co-operative skills by organizing colorful functions at regular intervals.

Every student of Mechanical Engineering will become a member of RVR & JC Mechanical Engineering Association (RAJMEA). It conducts Technical Seminars, Quizzes and Group Discussions by various students and arranges Guest Lectures by eminent persons from Industry and Academic Institutions. Short and Long Industrial Study Tours are arranged frequently to improve the knowledge base of the students. Mech Mantra is an annual feature organized by RAJMEA as a National Level Technical Students Meet in Mechanical Engineering.

A SAE (Society of Automotive Engineers) India Collegiate Club with the name FALCON RACERS is functioning with student and faculty members. The students voluntarily collect sponsorships from various industries and also from our management to design Vehicles. To mention a few , they have participated in National level reputed events and won prizes. Dr. A.P.J. Abdul Kalam patted our students and appreciated for their efforts in fabricating an off road Electric Vehicle.

The Department has been appreciated and adored by all the stakeholders for the successful implementation of policies. The feedback was taken at regular intervals and necessary actions were implemented for the benefit of the Department. Regular counseling and advice is also given to the students to improve their learning, ability and overall performance apart from guiding in their career

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R.V.R. & J.C. COLLEGE OF ENGINEERING :: GUNTUR
(Autonomous)

REGULATIONS (R-20) FOR
Four Year BACHELOR OF TECHNOLOGY (B.Tech.) Degree Programme

(w.e.f. the batch of candidates admitted into First Year B.Tech. from the academic year 2020-2021).

1 MINIMUM QUALIFICATIONS FOR ADMISSION

A candidate seeking admission into First Year of B.Tech. Degree Programme should have passed either Intermediate examination conducted by the Board of Intermediate Education, Andhra Pradesh with Mathematics, Physics, and Chemistry as optional subjects (or any equivalent examination recognized by the Acharya Nagarjuna University) or A candidate seeking admission into Second Year of B.Tech. Degree Programme should have passed either Diploma in Engineering in the relevant branch conducted by the State Board of Technical Education & Training of Andhra Pradesh (or equivalent Diploma recognized by Acharya Nagarjuna University).

The selection is based on the rank secured by the candidate at the EAMCET / ECET (FDH) examination conducted by A.P. State Council of Higher Education. The candidate shall also satisfy any other eligibility requirements stipulated by the University and / or the Government of Andhra Pradesh from time to time.

2 BRANCHES OF STUDY

The B.Tech. Course is offered in the following branches of study:

1. Chemical Engineering
2. Civil Engineering
3. Computer Science & Business Systems
4. Computer Science & Engineering
5. Computer Science & Engineering (Artificial Intelligence & Machine Learning)
6. Computer Science & Engineering (Data Science)
7. Computer Science & Engineering (Internet of Things)
8. Electrical & Electronics Engineering
9. Electronics & Communication Engineering
10. Information Technology
11. Mechanical Engineering

3 DURATION OF THE COURSE AND MEDIUM OF INSTRUCTION

3.1 The duration of the course is Four academic years consisting of two semesters in each academic year. The medium of instruction and examination is English.

3.2 The duration of the course for the candidates (Diploma Holders) admitted under lateral entry into Second Year B.Tech. is Three academic years consisting of two semesters in each academic year. The medium of instruction and the examination is English.

4 MINIMUM INSTRUCTION DAYS

Each semester shall consist of a minimum number of 90 days of instruction excluding the days allotted for tests, examinations and preparation holidays.

5 REGISTERING THE COURSES

5.1 A candidate has to register and secure 160 credits which include laboratory courses and project work. However, the candidate admitted under lateral entry has to register and secure 121 credits, which includes laboratory courses and project work.

5.2 Skill oriented / Skill advanced courses framework:

5.2.1 Out of the five skill courses two shall be skill-oriented courses from the same domain and shall be completed in second year.The remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature.

5.2.2 A pool of interdisciplinary job-oriented skill courses shall be designed by a common Board of studies by the participating departments/disciplines and the syllabus along with the pre requisites shall be prepared for each of the laboratory infrastructure requirements. The list of such courses shall be included in the curriculum structure of each branch of Engineering, so as to enable the student to choose from the list.

5.2.3 The candidate shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries / Professional bodies / APSSDC or any other accredited bodies as approved by the concerned BoS.

5.2.4 If a candidate chooses to take a Certificate Course offered by industries/ Professional bodies/APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the Department, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency/professional bodies as approved by the Board of studies.

5.2.5 If a candidate prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the concerned Board of Studies, the student is deemed to have fulfilled the attendance requirement of the course and acquire the credits assigned to the course.

5.2.6 A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades. The recommended conversions and appropriate grades/marks are to be approved by the Academic Council.

5.3 Honors / Minor Programme framework:

5.3.1 A candidate shall be eligible to register for Honor or Minor degree along with regular B.Tech degree. A candidate shall earn 20 credits in addition to the 160 credits to get Honor / Minor degree along with regular B.Tech degree. A candidate shall be permitted to register either for Honors or for Minor and not for both simultaneously.

5.3.2 A candidate (Regular / Lateral Entry) pursuing a major degree programme and having no outstanding backlogs in the previous semesters shall be permitted to register for a Honors / Minor program at the beginning of 4th semester. After registering the program, If a candidate fails to maintain a minimum of 8.00 CGPA in the subsequent semesters without backlogs, his/her registration for Honors / Minor program stands cancelled.

5.3.3 In case a student fails to meet the CGPA requirement for Degree with Honors / Minor at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors/ Minor and they will receive regular B.Tech degree only. However if he/she wants to study the courses offered in the program, they can continue. Such students will receive a grade sheet mentioning the additional courses completed by them.

5.3.4 Honors / Minor must be completed simultaneously with a major degree programme. A student cannot earn Honors / Minor after he/she has already earned bachelor's degree.

5.3.5 A Candidate is eligible to opt for Honors Programme offered by the concerned Department/Discipline and he/she will be awarded B.Tech. (Honors) in the concerned Discipline.

5.3.6 Candidates who are desirous of pursuing their special interest areas in chosen discipline of Engineering may opt for additional courses in minor specialization groups (Specialized Tracks) offered by the concerned department and he/she will get Major degree of concerned Discipline with minor degree of Specialized Track.

5.3.7 Candidates who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups (General Tracks) offered by the department other than their parent department and he/she will get Major degree of concerned Discipline with minor degree in other department.

5.3.8 Candidates can also opt for Industry relevant tracks of any branch like Data Mining track, IOT track, Machine learning track etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, VLSI etc. to obtain the Minor Degree and and he/she will get Major degree of concerned discipline with minor degree in industry track.

5.3.9 In the case of Honors, out of 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs courses, which shall be domain specific, each with 2 credits and with a minimum duration of 8 weeks as recommended by the Board of studies. If the MOOC course is a pass course without any grades, the grade to be assigned as decided by the Academic Council.

5.3.10 In the case of Minor, out of 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme. The remaining 4 credits must be acquired through two MOOCs courses. The courses must be of minimum 8 weeks in duration. Student has to acquire a certificate from the agencies approved by the BoS with grading or marks or pass. If the MOOC course is a pass course without any grades, the grade to be assigned as decided by the Academic Council.

5.3.11 If a candidate drops (or terminated) from the Honors / Minor programme, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degreecertificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

5.4 A candidate shall register for National Cadet Corps (NCC) / National Service Scheme (NSS) activities.

5.4.1 A candidate will be required to participate in an activity for two hours in a week during second and third semesters.

5.4.2 Grade shall be awarded as Satisfactory or Unsatisfactory in the grade sheet on the basis of participation, attendance, performance and behavior.

5.4.3 If a candidate gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.

5.4.4 The NCC / NSS programme will be held as announced by the respective Coordinator(s).

5.5 A candidate has to register and secure at least minimum pass grade in Mandatory Courses, for which no credits are awarded.

5.6 A candidate has to secure at least minimum pass grade in Value Added Courses offered by the individual departments, for which no credits are awarded.

5.7 MOOC (Massive Open Online Course):

5.7.1 A candidate shall complete two MOOC courses (One from Professional Elective course and another from Open Elective course) of 12 weeks in duration.

5.7.2 Enrollment of MOOC course will be initiated from the date of commencement of class work for Semester V [Third Year].

5.7.3 MOOC course completion certificate(s) must be submitted on or before the last instruction day of Semester VII [Fourth Year] to consider it for Regular evaluation. Otherwise it will be considered as Supplementary.

5.7.4 candidate has to pursue and acquire a certificate for a MOOC course only from the organizations / agencies approved by the concerned BoS in order to earn the 3 credits. List of organisations offering MOOC courses / List of courses will be announced by the respective Board of Studies at the time of commencement of class work for Semester V [Third Year].

5.8 Mandatory Internship framework:

5.8.1 Students shall undergo mandatory summer internships for a minimum of three weeks duration at the end of second year and minimum of six weeks duration third year of the Programme.

5.8.2 Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee. The report and the oral presentation shall carry 40% and 60% weightages respectively.

5.8.3 There shall also be mandatory full internship in the final semester of the Programme. In the final semester, the student should mandatorily undergo internship and parallelly he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

5.9 Gap - Year:

Gap Year - concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I year / II year / III year to pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at institute level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing the Gap Year.

6 EVALUATION

The performance of the candidates in each semester shall be evaluated Course wise.

6.1 The distribution of marks between Sessional Examination (based on internal assessment) and Semester End Examination is as follows:

Nature of the Courses	Sessional Marks	Semester End Exam. Marks
Theory Courses / Design and / or Drawing / Practicals	30	70
Skill Courses / Summer Internship/ Mandatory Course / Value Added Course	100	---
Project work	30	70
MOOC Course	---	100

6.2 In each of the Semesters, there shall be two Midterm examinations in every theory course. The Sessional marks to the midterm examinations shall be awarded giving a weightage of 15 marks out of 18 marks (80% approx.) to the midterm examination in which the candidate scores more marks and the remaining 3 marks (20% approx.) to the other midterm examination in which the candidate scores less marks.

A maximum of five marks are allotted for attendance in the respective theory courses in a graded manner as indicated in ***clause 8.2.*** The remaining 7 marks out of the 30 marks earmarked for the sessional marks are awarded based on the average of minimum two online quiz tests conducted by the concerned teacher in the respective theory courses.

6.3 The evaluation for Laboratory class work consists of a weightage of 15 marks for day to day laboratory work including record work and 15 marks for internal laboratory examination including Viva-voce examination.

In case of Project work, the sessional marks shall be awarded based on the performance in two Seminars and the Project Report submitted at the end of the semester.

NOTE : A candidate who is absent for any Mid Term / online quiz Exam, for any reason whatsoever, shall be deemed to have scored zero marks in that Test / Exam and no make-up test / Exam shall be conducted.

6.4 A candidate who could not secure a minimum of 50% aggregate sessional marks is not eligible to appear for the Semester End Examination and shall have to repeat that Semester.

6.5 The evaluation procedure of the courses offered in Honor / Minor Programme: There shall be two Mid Term examinations and two Assignment Tests in every course. The Sessional marks to the midterm examinations shall be awarded giving a weightage of 15 marks out of 18 marks (80% approx.) to the midterm examination in which the candidate scores more marks and the remaining 3 marks (20% approx.) to the other midterm examination in which the candidate scores less marks. The remaining 12 marks out of 30 marks earmarked for sessional marks are awarded based on the average of marks in two Assignment Test + Two online Quiz / Laboratory examinations.

6.6 A candidate who could not secure a minimum of 50% sessional marks and 75% attendance in the courses being attended is not eligible to appear for the Semester End Examination in that courses. Further candidates are not eligible to register for the remaining courses in the specified Honor / Minor Programme.

6.7 There is no supplementary examination for the failed subjects in Honor / Minor programme.

7 LABORATORY / PRACTICAL COURSES

In any semester, a minimum of 10 experiments / exercises specified in the syllabus for laboratory course shall be completed by the candidate and get the record certified by the concerned faculty and Head of the Department, to be eligible to face the Semester End Examination in that Practical course.

8 ATTENDANCE REGULATIONS

8.1 Regular course of study means a minimum of 50% attendance in each subject and an aggregate attendance of 75% in all the courses computed by totalling the number of hours / periods of lectures, design and / or drawing, practical's and project work as the case may be, held in every course as the denominator and the total number of hours / periods actually attended by the candidate in all the courses, as the numerator.

8.2 A weightage in sessional marks up to a maximum of 5 marks out of 30 marks in each theory course shall be given for those candidates who put in a minimum of 75% attendance in the respective theory in a graded manner as indicated below:

Attendance of 75% and above but less than 80%	- 2 mark
Attendance of 80% and above but less than 85%	- 3 marks
Attendance of 85% and above but less than 90%	- 4 marks
Attendance of 90% and above	- 5 marks

8.3 Condonation of shortage in attendance may be recommended on genuine medical grounds, up to a maximum of 10% provided the candidate puts in at least 65% attendance as calculated in ***clause 8.1***, provided the Principal is satisfied with the genuineness of the reasons and the conduct of the candidate. However, marks will not be awarded for condonation of shortage in attendance.

8.4 A candidate who could not satisfy the minimum attendance requirements in any semester as mentioned in ***clause 8.1***, is not eligible to appear for the Semester End Examinations and shall have to repeat the same Semester.

8.5 A candidate who could not satisfy the minimum 50% attendance in any subject / course is not eligible to appear for the Semester End Examination in that specified subject / course and shall have to repeat the same subject / course within one academic year after completion of that semester.

9 DETENTION

A candidate, who fails to satisfy either the minimum attendance requirements as stipulated in ***Clause-8***, or the requirement of minimum aggregate sessional marks as stipulated in ***Clause-6***, shall be detained. Such candidate shall have to repeat the same semester.

10 SEMESTER END EXAMINATION

10.1 For each theory course, there shall be a comprehensive Semester End Examination at the end of each Semester.

10.2 For each Practical course the Smester End Examination shall be conducted by one internal and one external examiner appointed by the Principal of the College, the duration being that approved in the detailed Schemes of Instruction & Examination.

10.3 Viva-voce Examination in Project Work shall be conducted by one internal examiner and one external examiner appointed by the Principal.

10.4 In addition to the Regular semester end examinations held at the end of each semester, supplementary examinations will also be conducted during the academic year. Such

candidates taking the Regular / Supplementary examinations as supplementary candidates may have to take more than one examination per day.

10.5 Instant examination will be conducted immediately after the declaration of Semester VIII [Fourth Year] results for those candidates who cleared all courses except one course in Semester VIII [Fourth Year].

11 CONDITIONS FOR PASS

A candidate shall be declared to have passed in individual course if he / she secures a minimum of 35% marks in theory and 50% marks in Practical courses/drawing courses/Project Viva-voce in Semester End Examination and minimum of 40% marks in both Sessional & Semester End Examination put together.

12 AWARD OF CREDITS

12.1 Credits are awarded for each Theory Course / Practical Course and Project Work.

12.2 AWARD OF GRADES

S.No.	Range of Marks	Grade	Grade Points
1	≥ 90	A^+	10.0
2	≥ 80 - < 90	A	9.0
3	≥ 70 - < 80	B	8.0
4	≥ 60 - < 70	C	7.0
5	≥ 50 - < 60	D	6.0
6	≥ 40 - < 50	E	5.0
7	< 40	F	0.0
8	The grade 'W' represents withdrawal / absent	W	0.0

12.3 A candidate securing 'F' grade in any course there by securing zero grade points has to reappear and secure at least 'E' grade in the subsequent examinations for that course.

12.4 After each semester, Grade sheet will be issued which will contain the following details:

- The list of courses for each semester and corresponding credits and grades obtained
- The Semester Grade Point Average (SGPA) for each semester and
- The Cumulative Grade Point Average (CGPA) of all courses put together up to that semester.

SGPA is calculated based on the following formula: $\frac{\sum [\text{ No. of Credits X Grade Points }]}{\sum \text{ No. of Credits}}$

CGPA will be calculated in a similar manner, considering all the courses up to that semester.

12.5 A consolidated Grade Sheet shall be issued to the candidate, after completing all , indicating the CGPA of all the Four / Three years put together.

12.6 Conversion of CGPA into equivalent Percentage.: Percentage of Marks =(CGPA-0.50)x10

13 CONDITIONS FOR PROMOTION

13.1 A candidate shall be eligible for promotion to next semester, if he/she satisfies the minimum requirements of attendance and sessional marks as stipulated in ***Clauses 6 and 8***.

13.2 A candidate shall be eligible for promotion to Third Year, if he / she secures 24 credits (40% approx.) of the total number of credits (60.5) upto Semester III [Second Year] from all

examinations by the time the classwork commences for Third Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in ***Clauses 6 and 8*** in Semester IV [Second Year].

13.3 A candidate shall be eligible for promotion to Fourth Year, if he / she secures 41 credits (40% approx.) of the total number of credits (103.5) upto Semester V [Third Year] from all examinations by the time the classwork commences for Fourth Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in ***Clauses 6 and 8*** in Semester VI [Third Year].

13.4 A candidate (Diploma Holder) admitted under lateral entry into Semester III, shall be eligible for promotion to Fourth Year, if he/she secures 25 credits (40% approx.) of the total number of credits (64.5) upto Semester V [Third Year] from all examinations by the time the classwork commences for Fourth Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in ***Clauses 6 and 8*** in Semester VI [Third Year]

14 ELIGIBILITY FOR AWARD OF B.TECH. DEGREE

The B.Tech. Degree shall be conferred on a candidate who has satisfied the following requirements:

14.1 The candidate must have satisfied the conditions for pass in all the courses of all the years as stipulated in ***Clauses 11***.

14.2 A candidate, who fails to fulfil all the academic requirements for the award of the B.Tech. degree within eight academic years from the year of admission, shall forfeit his/her seat in B.Tech. course.

14.3 A candidate (Diploma Holder) admitted under lateral entry into Second Year B.Tech., who fails to fulfil all the academic requirements for the award of the B.Tech. degree within six academic years from the year of admission, shall forfeit his/her seat in B.Tech. course.

15 AWARD OF CLASS

A candidate who becomes eligible for the award of B.Tech. Degree as stipulated in ***Clause 12*** shall be placed in one of the following Classes.

S.No.	Class	CGPA
1	First Class With Distinction	7.5 or more
2	First Class	6.5 or more but less than 7.5
3	Second Class	5.5 or more but less than 6.5
4	Pass Class	5.0 or more but less than 5.5

16 IMPROVEMENT OF CLASS

A candidate, after becoming eligible for the award of the Degree, may improve the CGPA by appearing for the Semester End Examination in any of the theory course as and when conducted. But this provision shall be within a period of two academic years after becoming eligible for the award of the Degree. However, this facility cannot be availed by a candidate who has taken the Original Degree Certificate.

17 AWARD OF RANK

The rank shall be awarded based on the following:

17.1 Ranks shall be awarded in each branch of study for the top five percent of the candidates appearing for the Regular Semester End Examinations or the top ten candidates whichever is minimum.

17.2 Only such candidates who pass the Final year examination at the end of the fourth/third academic year after admission as regular final year candidate along with others in their batch and become eligible for the award of the degree shall be eligible for the award of rank. The Rank will be awarded only to those candidates who complete their degree within four/three academic years.

17.3 For the purpose of awarding rank in each branch, only such candidates who passed all courses in the first attempt only shall be considered.

18 TRANSITORY REGULATIONS

A Candidate, who is detained or discontinued in the semester, on readmission shall be required to do all the courses in the curriculum prescribed for such batch of candidates in which the candidates joins subsequently.

18.1 A candidate, studied under R-18 regulations of RVR & JCCE (Autonomous) curriculum, detained due to lack of academics/attendance at the end of the Semester II [First Year] or Semester III [Second Year], shall join in appropriate Semester of R-20 regulations. The candidate has to clear all the backlog subjects or equivalent subjects if any under R-20 curriculum by appearing the supplementary examinations, conducted by the college under R-20 curriculum. The class will be awarded based on the academic performance of the candidate as R-20 regulations.

18.2 A candidate, studied under R-18 regulations of RVR & JCCE (Autonomous) curriculum, detained due to lack of academics / attendance at the end of the Semester IV [Second Year] and also at the subsequent semesters will follow the same R-18 regulations/curriculum and he/she has to complete all the courses by appearing in the examination conducted by the college under R-18 curriculum. The class will be awarded based on the academic performance of the candidate as per R-18 regulations.

18.3 A candidate, transferred from other institutions / universities into Semester II [Second Year] and also at the subsequent semesters of B.Tech., shall join at appropriate semester of R-20 curriculum. Such candidate shall study all the courses prescribed for that batch, in which, the candidate joins. The candidate has to clear the backlog courses, if any, in the semesters which he/she has studied in the earlier institutions / universities by appearing the supplementary examinations conducted by the college in R-20 circulum courses / equivalent courses. The equivalent courses will be decided by concerned Board of Studies.

19 CONDUCT AND DISCIPLINE

19.1 Candidates shall conduct themselves within and outside the premises of the institute in a manner befitting the candidates of our institution.

19.2 As per the order of Honourable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.

19.3 The following acts of omission and / or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.

a Lack of courtesy and decorum, indecent behaviour anywhere within or outside the campus.

b Wilful damage of college / individual property

c Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.

d Mutilation or unauthorized possession of library books.

e Noisy and unseemly behaviour, disturbing studies of fellow candidates.

f Hacking of computer systems (such as entering into other person's areas without prior permission, manipulation and / or damage of computer hardware and software or any other cyber-crime etc.)

g Usage of camera / cell phone in the campus

h Plagiarism of any nature

i Any other acts of gross indiscipline as decided by the academic council from time to time.

19.4 Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute / hostel, debar from examination, disallowing the use of certain facilities of the institute, rustication for a specified period or even outright expulsion from the institute or even handing over the case to appropriate law enforcement or the judiciary, as required by the circumstances.

19.5 For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief warden, the head of the department and the principal respectively, shall have the authority to reprimand or impose fine.

19.6 Cases of adoption of unfair means and / or any malpractice in an examination shall be reported to the principal for taking appropriate action.

19.7 All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the academic council.

19.8 The institute level standing disciplinary action committee constituted by the academic council shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.

19.9 The principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the programmes committee in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved by the appropriate authority, shall be reported to the academic council for ratification.

20.10 ''Grievance and Redressal Committee'' (General) constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters.

20 MALPRACTICES

20.1 The Principal shall refer the cases of malpractices in internal assessment tests and semester-end examinations to a malpractice enquiry committee constituted by him / her for the purpose. Such committee shall follow the approved scales of punishment. The principal shall take necessary action, against the erring candidates basing on the recommendations of the committee.

20.2 Any action on the part of a candidate during an examination trying to get undue advantage or trying to help another, or drive the same through unfair means is punishable according to

the provisions contained hereunder. The involvement of the staff, who are in-charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned in the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

21 AMENDMENTS TO REGULATIONS

The College may, from time to time, revise, amend, or change the Regulations, Schemes of Examinations, and / or Syllabus.

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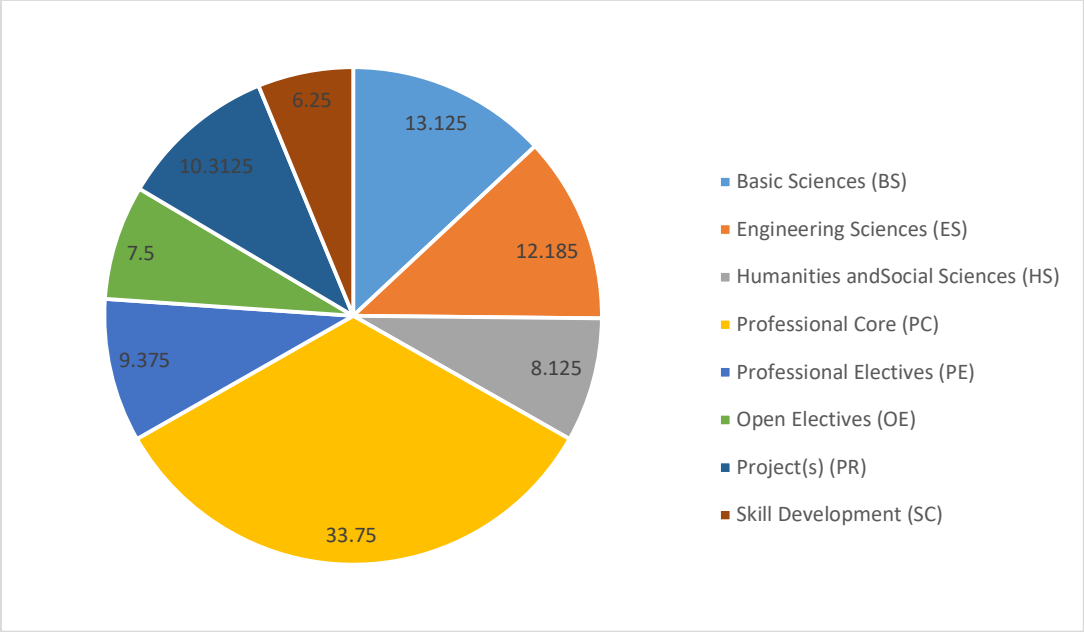
DEPARTMENT OF MECHANICAL ENGINEERING

B.TECH. MECHANICAL ENGINEERING

Program curriculum grouping based on course components

Course Component	Curriculum Content (% of total number of credits program)	Credits as per AICTE	Total number of credits
Basic Sciences (BS)	13.125	25	21
Engineering Sciences (ES)	12.185	24	19.5
Humanities and Social Sciences (HS)	8.125	12	12
Professional Core (PC)	33.75	48	54
Professional Electives (PE)	9.375	18	15
Open Electives (OE)	7.5	18	12
Project(s) (PR)	10.3125	15	16.5
Skill Development (SC)	6.25	--	10
Mandatory Course(s) (MC)	--	--	--
Total number of Credits		160	160



B.TECH. MECHANICAL ENGINEERING

(w.e.f. the batch of students admitted from the academic year 2020-2021)

Three Weeks Orientation Programme is Mandatory before starting Semester I [First Year]

Semester I [First Year] COURSESTRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	ME 111	Mathematics-I	2	1	-	30	70	3	BS
2	ME 112	Engineering Chemistry	2	1	-	30	70	3	BS
3	ME113	English for Communication Skills	3	-	-	30	70	3	HS
4	ME 114	Programming For Problem Solving	3	-	-	30	70	3	ES
5	ME 151	Chemistry Lab	-	-	3	30	70	1.5	BS
6	ME152	English Language Communication Skills Lab	-	-	3	30	70	1.5	HS
7	ME 153	Engineering Workshop Practice Lab	1	-	4	30	70	3	ES
8	ME 154	Programming for Problem Solving Lab			3	30	70	1.5	ES
9	MEMC1	Environmental Science	2	-	-	100	-	-	MC
10		Three Weeks Orientation Programme	-	-	-	-	-	-	
		TOTAL	13	2	13	340	560	19.5	TPW-28

Semester II [First Year] COURSESTRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	ME 121	Mathematics-II	2	1	-	30	70	3	BS
2	ME122	Engineering Physics	3	-	-	30	70	3	BS
3	ME 123	Basic Electrical and Electronics Engineering	2	1	-	30	70	3	ES
4	ME124	Engineering Mechanics	2	1	-	30	70	3	ES
5	ME125	Engineering Graphics	1	-	4	30	70	3	ES
6	ME161	Physics Lab	-	-	3	30	70	1.5	BS
7	ME 162	Computer Aided Geometrical Modeling Lab	-	-	3	30	70	1.5	ES
8	ME163	Basic Electrical and Electronics Engineering Lab	-	-	3	30	70	1.5	ES
9	MEMC2	Constitution of India	2	-	-	100	-	-	MC
		TOTAL	12	3	13	340	560	19.5	TPW-28

Semester III [Second Year] COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	ME 211	Operations Management	2	1	-	30	70	3	PC
2	ME 212	Material Science & Metallurgy	3	-	-	30	70	3	BS
3	ME 213	Manufacturing Processes	3	-	-	30	70	3	PC
4	ME214	Basic Thermodynamics	2	1	-	30	70	3	PC
5	ME 215	Theory of Mechanisms & Machines	2	1	-	30	70	3	PC
6	ME 251	Machine Drawing Lab	-	-	3	30	70	1.5	PC
7	ME 252	Modeling Lab	-	-	3	30	70	1.5	PC
8	ME 253	Advanced programming lab	-	-	3	30	70	1.5	ES
9	**MESL1**	Skill Oriented Course -I	1	-	2	100	-	2	SC
10	MEMC3	Professional Ethics & Human values	2	-	-	100	-	-	MC
		TOTAL	15	3	11	440	560	21.5	TPW-29

Semester IV [Second Year] COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	ME 221	Mathematics - III (PDE, Probability & Statistics)	2	1	-	30	70	3	BS
2	ME 222	Applied Thermodynamics	2	1	-	30	70	3	PC
3	ME 223	Strength of materials	3	-	-	30	70	3	PC
4	ME 224	Manufacturing Technology	3	-	-	30	70	3	PC
5	ME 225	Fluid Mechanics & Hydraulic Machines	2	1	-	30	70	3	PC
6	ME 261	Manufacturing Process Lab	-	-	3	30	70	1.5	PC
7	ME 262	FM & SM Lab	-	-	3	30	70	1.5	PC
8	ME 263	Communicative English Lab	-	-	3	30	70	1.5	HS
9	**MESL2**	Skill Oriented Course: II	1	-	2	100		2	SC
10	MEMC4	Design Thinking & Product Innovation	2	-	-	100	-	-	MC
		TOTAL	15	3	11	440	560	21.5	TPW-29
Internship 3 to 4 weeks (minimum 3 weeks-Mandatory) during summer vacation (to be evaluated during next semester)									
Honors/Minor course (Maximum Two courses can be registered)			4	-	-	30	70	4	HR/MR

Semester V [Third Year] COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	ME 311	Design of Machine Elements	2	1	-	30	70	3	PC
2	ME 312	Metrology & Measurements	2	1	-	30	70	3	PC
3	ME 313	Machine Dynamics and Vibrations	2	1	-	30	70	3	PC
4	ME 314	Professional Elective-I	3	-	-	30	70	3	OE
5	ME 315	Open / Job-Oriented Elective-I	2	-	2	30	70	3	PE
6	ME 351	CAM Lab	-	-	3	30	70	1.5	PC
7	ME 352	Thermal Engineering Lab	-	-	3	30	70	1.5	PC
8	ME 353	Summer Internship	-	-	-	100		1.5	PR
9	**MESL3**	Skill Oriented Course: III	1	-	2	100		2	SC
		TOTAL	12	3	10	410	490	21.5	TPW-25
Honors/Minor course (Maximum Two courses can be registered)			4	-	-	30	70	4	HR/MR

Semester VI [Third Year] COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	ME 321	Design of Transmission Elements	2	1	-	30	70	3	PC
2	ME 322	Operations Research	3	-	-	30	70	3	PC
3	ME 323	Heat Transfer	2	1	-	30	70	3	PC
4	ME 324	Professional Elective-II	3	-	-	30	70	3	PE
5	ME 325	Open / Job-Oriented Elective-II	2	-	2	30	70	3	OE
6	ME 361	Design & Metrology Lab	-	-	3	30	70	1.5	OE
7	ME 362	Heat Transfer Lab	-	-	3	30	70	1.5	PC
8	ME 363	Analysis Lab	-	-	3	30	70	1.5	PC
9	**MESL4**	Skill Oriented Course: IV	**1**	**-**	**2**	100		2	SC
		TOTAL	13	2	13	370	530	21.5	TPW-28
Internship 6 to 8 weeks (minimum 6 weeks-Mandatory) during summer vacation (to be evaluated during next semester)									
Honors/Minor course (Maximum Two courses can be registered)			4	-	-	30	70	4	HR/MR

Semester VII [Fourth Year] COURSESTRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			MaximumMarks		Credits	
			L	T	P	SES	EXT		
1	ME 411	Humanities Elective	3	-	-	30	70	3	HS
2	ME 412	Professional Elective-III	3	-	-	30	70	3	PE
3	ME 413	Professional Elective-IV	3	-	-	30	70	3	PE
4	ME 414	Professional Elective-V [MOOCS]	-	-	-	30	70	3	PE
5	ME 415	Open / Job-Oriented Elective-III	2	-	2	30	70	3	OE
6	ME 416	Open / Job-Oriented Elective-IV [MOOCS]	-	-	-	30	70	3	OE
7	ME 451	Internship / Certification	-	-	-	100		3	PR
8	**MESL5**	Skill Oriented Course: V	1	-	2	100		2	SC
		TOTAL	12	0	4	380	420	23	TPW-16
Honors/Minor course (Maximum Two courses can be registered)			4	-	-	30	70	4	HR/MR

Semester VIII [Fourth Year] COURSESTRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	ME461	Project Work, Seminar and Internship in Industry	-	-	-	30	70	12	PR
		TOTAL	0	0	0	30	70	12	TPW-0

Professional Elective Courses

Code No.	Subject Name	Code No.	Subject Name
MEEL1	Computer Aided Design	MEEL3	Mechatronic System Design
MEEL2	Finite element Methods	MEEL4	Fluidics and control systems
MEEL5	Industrial Robotics	MEEL6	I C Engines and Gas Turbines
MEEL7	Refrigeration and Air Conditioning	MEEL8	Automobile Engineering
MEEL9	Elements of Aerospace Engineering	MEEL10	Power Plant Engineering
MEEL11	Energy Conservation & Management	MEEL12	Automation in Manufacturing
MEEL13	Composite Materials	MEEL14	Advanced Metal Casting
MEEL15	Safety in Engineering Industry	MEEL16	Maintenance Engineering
MEEL17	Product Lifecycle Management	MEEL18	Industrial Management
MEEL19	Process Planning and Cost Estimation	MEEL20	Total Quality Management

Design	**Thermal**	**Production**	**Industrial**
MEEL1 Computer Aided Design	MEEL6 I C Engines and Gas Turbines	MEEL12 Automation in Manufacturing	MEEL17 Product Lifecycle Management
MEEL2 Finite element Methods	MEEL7 Refrigeration and Air Conditioning	MEEL13 Composite Materials	MEEL18 Industrial Management
MEEL3 Mechatronic System Design MEEL4 Fluidics and control systems	MEEL8 Automobile Engineering MEEL9 Elements of Aerospace Engineering	MEEL14 Advanced Metal Casting	MEEL19 Process Planning and Cost Estimation
MEEL5 Industrial Robotics	MEEL10 Power Plant Engineering MEEL11 Energy Conservation & Management	MEEL15 Safety in Engineering Industry MEEL16 Maintenance Engineering	MEEL20 Total Quality Management

Skill Courses

Code No.	Subject Name	Code No.	Subject Name
MESL1	Data Structures & Algorithms	MESL2	Numerical Techniques & Simulation
MESL3	Soft Skills	MESL4	Advanced Modelling Lab
MESL5	Automation Lab		

Open Elective Courses (Offered by other Departments)

Code No.	Subject Name	Code No.	Subject Name
CEOL1	Basic Surveying	CEOL2	Building Materials and Construction
CHOL1	Energy Engineering	CHOL2	Solid Waste Management
CSOL1	Programming with Java	CSOL2	Relational Database Management Systems
CBOL1	Operating Systems Concepts	CBOL2	Business Analytics
CMOL1	Fundamentals of Artificial Intelligence	CMOL2	Programming with C++
CDOL1	Python for Data Science	CDOL2	Data Science for Engineers
COOL1	Architecting Smart IoT Devices	COOL2	Fog Computing
ECOL1	Applied Electronics	ECOL2	Microprocessors & Interfacing
ECOL3	Linear ICs and Applications	EEOL1	Renewable Energy Sources
EEOL2	Utilization of Electrical Energy	ITOL1	Data Structures & Algorithms
ITOL2	Web Technologies		

Elective Courses offered by Science & Humanities Department

Code No.	Subject Name	Code No.	Subject Name
HSEL1	Industrial Management & Entrepreneurship	HSEL2	Economics for Engineers
HSEL3	Introduction to Industrial Management	HSEL4	Project Management & Entrepreneurship

Job Oriented Elective Courses

Course Code	Course Name	Course Code	Course Name
JOEL01	Big Data Processing	JOEL12	Building Planning
JOEL02	Full Stack Development	JOEL13	Quantity Estimation
JOEL03	JavaScript Technologies	JOEL14	Bio Fuels
JOEL04	Cloud Computing using AWS	JOEL15	Environmental Engineering
JOEL05	DevOps	JOEL16	Safety Management
JOEL06	Enterprise Programming	JOEL17	Non-Conventional Energy Engineering
JOEL07	Predictive Modeling and Analysis	JOEL18	Biopharmaceutics and Drug Design
JOEL08	Data warehousing and mining	JOEL19	Embedded Systems-1
JOEL09	Interface and Programming With IoT Gateway	JOEL20	Embedded Systems-2
JOEL10	IoT Cloud and Data Analytics	JOEL21	Open Source Systems
JOEL11	Geospatial Technology	JOEL22	Machine Learning

HONORS COURSES

Course Code	COURSE NAME	L-T-P	CR	PRE-REQ.
POOL1[Design]				
MEH11	Advanced Strength of Materials	3-1-0	4	Strength of Materials
MEH12	Fracture Mechanics	3-1-0	4	Strength of Materials, Metallurgy
MEH13	Design of Manufacturing & Assembly	3-1-0	4	Strength of Materials
MEH14	Advanced Optimization Techniques	3-1-0	4	Dynamics of machinery
POOL2 [Production]				
MEH21	Advanced Materials & Processing	4-0-0	4	Manufacturing Process
MEH22	Computer Integrated Manufacturing & Automation	4-0-0	4	Manufacturing Technology
MEH23	Non Traditional Machining	4-0-0	4	Manufacturing Technology
MEH24	Additive Manufacturing	4-0-0	4	Manufacturing Processes & Manufacturing Technology
POOL3 [Thermal]				
MEH31	Computational Fluid Dynamics	3-1-0	4	Fluid Mechanics
MEH32	Gas Dynamics & Jet Propulsion	3-1-0	4	Basic Thermodynamics
MEH33	Alternate Fuels & Energy Systems	3-1-0	4	Basic Thermodynamics, I.C Engines
MEH34	Advanced IC Engines	3-1-0	4	IC Engines
POOL4[Industrial]				
MEH41	Design of Experiments	3-1-0	4	Mathematics-III
MEH42	Production Planning & Control	3-1-0	4	Industrial Engineering
MEH43	Supply Chain Management & Logistics	4-0-0	4	Industrial Engineering
MEH44	Quality Control & Reliability	4-0-0	4	Industrial Engineering

Note:

1. **Students has to acquire 16 credits with minimum one subject from each pool. (04 courses@4 credits each)**
2. **Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)**

General Minor Courses (Offered by other Department)

Note: 1. A student can opt any 4 subjects from each pool @ 4 credits per subject.
2. Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)

Offered by Civil Engineering

Code No.	Subject Name	Code No.	Subject Name
CEMR1	Geomatics (Survey, GIS & GPS)	CEMR2	Construction Engineering & Management
CEMR3	Fundamentals of Structural Engineering	CEMR4	Water Resource Engineering
CEMR5	Environmental Engineering	CEMR6	Geotechnical Engineering
CEMR7	Transportation Engineering		

Offered by Chemical Engineering

Code No.	Subject Name	Code No.	Subject Name
CHMR1	Unit Operations	CHMR2	Principles of Chemical Process Calculations
CHMR3	Transfer operations	CHMR4	Reaction Engineering
CHMR5	Industrial Pollution Control Engineering	CHMR6	Principles of Safety Management

Offered by Computer Science & Engineering

Code No.	Subject Name	Code No.	Subject Name
CSMR1	Fundamentals of Data Structures	CSMR2	Computer Organization and Architecture
CSMR3	Operating System Concepts	CSMR4	Relational DataBase Management System
CSMR5	Programming with JAVA	CSMR6	Introduction to Algorithms
CSMR7	Principles of Software Engineering	CSMR8	Computer Networking Concepts

Offered by Computer Science & Engineering (DS)

Code No.	Subject Name	Code No.	Subject Name
CDMR1	Introduction to Data Science & Machine Learning	CDMR2	Analysing, Visualizing and Applying Data Science with Python
CDMR3	Web Data Mining	CDMR4	Business Analytics
CDMR5	Data Science for Engineers	CDMR6	Deep Learning

Offered by Computer Science & Engineering (AIML)

Code No.	Subject Name	Code No.	Subject Name
CMMR1	Introduction to Artificial Intelligence	CMMR2	Machine Learning
CMMR3	Data Analytics	CMMR4	Deep Learning
CMMR5	Natural Language Processing	CMMR6	Soft Computing

Offered by Computer Science & Engineering (IoT)

Code No.	Subject Name	Code No.	Subject Name
COMR1	Introduction to Internet of Things	COMR2	IoT Architecture and Protocols
COMR3	IoT Cloud and Data Analytics	COMR4	Smart Sensor Technologies
COMR5	Fundamental of IoT	COMR6	Introduction of Raspberry Pi and Arduino

Offered by Information Technology

Code No.	Subject Name	Code No.	Subject Name
ITMR1	Database Managent Systems	ITMR2	Unix and Shell Programming
ITMR3	Computer Networks	ITMR4	Software Engineering
ITMR5	Cryptography and Network Security	ITMR6	Machine Learning

General Minor Courses (Offered by other Department)

Note : 1. A student can opt any 4 subjects from each pool @ 4 credits per subject.
2. Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)

Offered by Electrical & Electronics Engineering

Code No.	Subject Name	Code No.	Subject Name
EEMR1	Electrical Machines Theory & Performance	EEMR2	Electrical Power Generation & Utilization
EEMR3	Power Systems Engineering	EEMR4	Power Converters & Applications
EEMR5	Electrical Measurements & Instrumentation	EEMR6	Electric Vehicles

Offered by Mechanical Engineering

Code No.	Subject Name	Code No.	Subject Name
MEMR1	Engineering Mechanics	MEMR2	Strength of Materials and Fluid mechanics
MEMR3	Manufacturing Processes	MEMR4	Concepts of Thermal Engineering
MEMR5	Concepts of Mechanical Design	MEMR6	Computer Aided Design & Manufacturing
MEMR7	Additive Manufacturing		

Industry Track - Minor Courses

Note : 1. A student can opt any 4 subjects from each Track @ 4 credits per subject.
2. Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)

Minor in Industrial Automation & Robotics (Offered by Mechanical Engineering)

Code No.	Subject Name	Code No.	Subject Name
ARMR1	Robotic Engineering	ARMR2	Mechatronics and Microcontrollers
ARMR3	Industrial Automation	ARMR4	Computer integrated Manufacturing
ARMR5	Fluidics and Control Systems	ARMR6	Mechanics of Robots

Minor in Full Stack Development (Offered by Computer Science & Business Systems)

Code No.	Subject Name	Code No.	Subject Name
FSMR1	User Interface Design	FSMR2	Client Side Scripting
FSMR3	React JS	FSMR4	MEAN stack (MongoDB, Express JS, Angular JS, Node JS)
FSMR5	C# (.NET Framework)	FSMR6	Web Application Development Using ASP

Minor in Cloud Computing (Offered by Computer Science & Engineering - Data Science)

Code No.	Subject Name	Code No.	Subject Name
CCMR1	Principals of Cloud Computing	CCMR2	Cloud Virtualization
CCMR3	Cloud Application Development	CCMR4	Cloud Security
CCMR5	Edge Computing	CCMR6	Block Chain Security

Minor in VLSI (Offered by Electronics & Communication Engineering)

Code No.	Subject Name	Code No.	Subject Name
VLMR1	HDL Programming	VLMR2	System Verilog and UVM
VLMR3	Synthesis and Formal Verification	VLMR4	Design for Testability
VLMR5	Physical Design Fundamentals	VLMR6	Advanced Physical Design

Minor in Electric Vehicles (Offered by Electrical & Electronics Engineering)

Code No.	Subject Name	Code No.	Subject Name
EVMR1	Energy Systems and Electrical Machines	EVMR2	Hybrid Electric Vehicles
EVMR3	Plug-in Electric vehicles	EVMR4	Electric Vehicle Power Train
EVMR5	Autotronics	EVMR6	BMS & Charging stations

I YEAR

ME 111	MATHEMATICS-I	L	T	P	C	Int	Ext
	(Calculus & Matrix Theory)	2	1	-	3	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

1. To familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra.
2. To equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Evaluate certain improper integrals.
2. Apply Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. Find Fourier series and deal with functions of several variables.
4. Solve problems on matrices and linear algebra in a comprehensive manner.

COURSE CONTENT:

UNIT I **[CO:1] (12)**

Evolutes and Involutes, Evaluation of improper integrals: Integrals without infinite limits of integration, Beta function, Gamma function, Relation between beta and gamma functions (without proof), Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT II **[CO:2] (12)**

Rolle's theorem (without proof), Lagrange's mean value theorem (without proof), Taylor's and Maclaurin series (without proof), Sequences, Series, Series of positive terms, Convergence tests: Comparison test (limit form) D'Alembert's ratio test, Raabe's test for convergence.

UNIT III **[CO:3] (12)**

Fourier series: Half range sine and cosine series, Parseval's formula. Multivariable Calculus: Limit, continuity and partial derivatives, total derivative, Maxima, minima and saddle points of two variables, Method of Lagrange multipliers. Scalar and vector point functions , Gradient, directional derivative divergence and curl, del applied twice to point and product of point functions(without proofs).

UNIT IV **[CO:4] (12)**

Rank of a matrix, Normal form, Inverse by Gauss Jordan method, System of linear equations: non homogeneous, Homogeneous systems, Rank-nullity theorem (without proof), Eigenvalues and eigenvectors, Cayley-Hamilton Theorem (without proof), Diagonalization of matrices, reduction of quadratic form to canonical form.

LEARNING RESOURCES:

TEXT BOOK:

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 42nd edition, 2017.

REFERENCE BOOK(s):

1. G.B. Thomas and R.L. Finney - Calculus and Analytic geometry, Pearson,2002.
2. N.P. Bali and Manish Goyal - A text book of Engineering Mathematics, LaxmiPublications, Reprint,2010.
3. Erwin Kreyszig - Advanced Engineering Mathematics, John Wiley & Sons,2006.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

ME 112	ENGINEERING CHEMISTRY	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

1. To imparts concepts involved in molecular structure and inter molecular forces.
2. To understand the chemistry behind electrochemical energy systems.
3. To understand the chemical concepts involved in Water treatment and Corrosion.
4. To understand the about the major organic reactions and end products like conducting polymers.
5. To learn the analytical methods useful in characterization of compounds.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Identify stable complexes and suitable electrochemical energy systems for end usage.
2. Demonstrate the knowledge for effective water treatment and corrosion prevention.
3. Illustrate chemical reactions used in drug and polymer preparations.
4. Analyze the given compound using analytical techniques.

COURSE CONTENT:

UNITI [CO:1] (12)

Molecular structure, Intermolecular forces and Energy systems:

Crystal field theory-salient features, energy level diagrams-tetrahedral and octahedral complexes, crystal field stabilization energies and magnetic properties.

Ionic, dipolar, Vander Waal's interaction and Hydrogen bonding, critical phenomena - Andrew's isotherms of CO_2, derivation of critical constants from Vander Waal's equation.

Electrode potential, electrochemical series, Nernst equation and its applications. Batteries-Primary (Dry cell) and secondary (Lead acid), Lithium battery (Li-MnO_2)- advantages, Fuel cell (H_2–O_2cell).

UNIT II [CO:2] (12)

Water Chemistry and Corrosion :

Water Chemistry - WHO standards, Municipal water treatment-Removal of suspended impurities - Sedimentation, Co-agulation and Filtration-Disinfection of water by chlorine, Break point chlorination, Dechlorination, Purification by ion-exchange method and reverse osmosis.

Corrosion-Introduction, Electrochemical theory of corrosion, galvanic corrosion, differential aeration corrosion, Factors-temperature, pH, overvoltage. Cathodic protection by sacrificial anodic method and impressed current method. Electroplating (Cu), Electroless plating (Ni).

UNITIII **[CO:3] (12)**

Organic reactions and Polymers :

Types of organic reactions-Substitution($SN^1$and SN^2), Elimination ($E^1$and E^2), Addition-Markownikoff's rule and anti-Markownikoff's rule, Cyclisation (Diel's Alder reaction), Synthesis of aspirin.

Polymers - Functionality, Degree of Polymerization, Tacticity-Addition and condensation polymerization, Relationship between Structure and Properties of polymers (Strength, Crystallinity, Elasticity, Plastic Deformation, Glass transition temperature (Tg)), Factors affecting Tg.

Conducting polymers: Introduction, Examples, General applications, Mechanism of conduction in polyacetylene.

UNIT IV **[CO:4] (12)**

Spectroscopic techniques and its applications :

Beer-Lambert's law, limitations, colorimetric determination of Fe(III) UV-VIS spectroscopy-electronic transitions, shifts-blue and red, Block diagram - brief introduction of components, Applications - purity and differentiation of conjugated and non-conjugated dienes.

IR Spectroscopy - condition to be IR active, vibrational modes of - AB_2 , Block diagram-brief introduction of components, IR spectrum of CO_2 and H_2O molecules, General applications. Fluorescence and its applications in medicine.

LEARNING RESOURCES:

TEXT BOOK(s):

1. P.C. Jain and Monica Jain- Engineering chemistry, 16th edition, Dhanpat Rai Publishing Company.
2. Wiley Engineering chemistry, 2nd edition, Wiley India Private Limited.

REFERENCE BOOK(s):

1. Bruce H. Mahan, University Chemistry, 3rd edition, Narosa Publishing House..
2. ShashiChawla - A text book of Engineering chemistry, 3rd edition, Dhanpat Rai Publishing Company..

WEB RESOURCES:

1. Engineering Chemistry (NPTEL Web Book by B.L. Tembe, Kamaluddin & M.S.Krishnan).
2. http://www.powerstream.com/BatteryFAQ.html#lec
3. http://freevideolectures.com/Course/3029/Modern-Instrumental-Methods-ofAnalysis.

ME 113	ENGLISH FOR COMMUNICATION SKILLS	L	T	P	C	Int	Ext
		3	-	-	3	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

1. To enable students improve their lexical and communicative competence and to equip students with oral and written communication skills.
2. To help students understand and learn the correct usage and application of Grammar principles.
3. To get them acquainted with the features of successful professional communication.
4. To enable students acquire various specific features of effective written communication.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Utilize vocabulary effectively and meaningfully across diverse communication contexts, demonstrating proficiency.
2. Demonstrate competency in composing written communications, showcasing versatility in formats and styles appropriate for professional environments.
3. Execute grammatical principles accurately and effectively in both spoken and written communication.
4. Develop advanced writing skills and implement them to achieve effective communication objectives in professional settings.

COURSE CONTENT:

UNITI **[CO:1](12)**

Vocabulary Building

- Root words from foreign languages and their use in English.

- Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

- Synonyms, antonyms, and standard abbreviations.

- One word substitutes.

UNIT II **[CO: 2] (12)**

Writing Skills

2.1 - Proposal writing

2.2 - Letter-writing

2.3 - Techniques for writing precisely (precis writing)

2.4 - E-mail writing

UNIT III **[CO:3] (12)**

Identifying Common Errors in Writing

3.1 Subject-verb agreement

3.2 Noun-pronoun agreement

3.3 Articles

3.4 Prepositions

3.5 Tenses

3.6 Redundancies

UNIT IV **[CO:4] (12)**

Nature and Style of Sensible Writing

4.1 - Description & Narration (Paragraph Writing).[CO:1,2,3]

4.2 - Essay Writing (Expository Essay).[CO:1,2,3]

4.3 - Note-Making and Note-Taking.[CO:1,2,4]

4.4 - Methods of preparing notes.[CO:1,2,4]

LEARNING RESOURCES:

TEXT BOOK:

Communication Skills. Sanjay Kumar and PushpaLata . Oxford University Press.

REFERENCE BOOK(s):

1. Remedial English Grammar. F.T. Wood. macmillan.2007
2. On Writing Well. William Zinsser. Harper ResourceBook.2001
3. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge UniversityPress.2006.
4. Practical English Usage. Michael Swan. OUP.1995Press

ME 114	PROGRAMING FOR PROBLEM SOLVING	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER I [FIRST YEAR]						

Course Objectives

At the end of the course, the student will understand the

- Basic problem solving process using Flow Charts and algorithms.
- Basic concepts of control structures in C.
- Concepts of arrays, functions, pointers and Dynamic memory allocation in C.
- Concepts of structures, unions, files and command line arguments in C.

Course Outcomes

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

- Develop algorithms and flow charts for simple problems.
- Use suitable control structures for developing code in C.
- Design modular programs using the concepts of functions and pointers.
- Develop code for complex applications using structures and file handling features.

COURSE CONTENT:

UNIT I

Introductory Concepts: Block Diagram of Computer, Computer Characteristics, Hardware vs Software, How to Develop a Program, Software Development Life Cycle, Structured Programming, Types of Programming Languages, Introduction to C program, Program Characteristics.
Introduction to C Programming: Character set, Identifiers and Keywords, Data types, Constants, type qualifiers, Declaration and Initialization of variables.
Operators & Expressions: Arithmetic Operators, Unary Operators, Relational and Logical Operators, Assignment Operators, Conditional Operator, Input/ Output functions.

UNIT II

Control Statements: Branching, Looping, Nested Control Structures, Switch Statement, Break Statement, continue Statement, and Goto Statement
Arrays: Defining an Array, Processing an Array, Multidimensional Arrays & Strings.

UNIT III

Functions: Defining a Function, Accessing a Function, Function prototypes, Passing Arguments to a Function, Passing Arrays to Functions, Recursion, Storage Classes
Pointers: Fundamentals, Pointer Declarations, Passing Pointers to a Function, Pointers and Arrays, Dynamic memory allocation, Operations on Pointers, Arrays of Pointers.

UNIT IV
Structures and Unions: Defining a Structure, Processing a Structure, User-Defined Data Types, Structures and Pointers, Passing Structures to Functions, Self Referential Structures, Unions.
Files Handling: Opening and Closing a Data File, Reading and Writing a Data File, Processing a Data File, Unformatted Data Files, Accessing the File Randomly.
Command line arguments, C-preprocessor directives.

Learning Resources:

Text Book:

1. Programming with C (Schaum's Outlines) by Byron Gottfried, Third Edition, Tata McGraw-Hill.

Reference Books:

1. Programming in C by Stephen G. Kochan, Fourth Edition,PearsonC Complete Reference, Herbert Sheildt, TMH., 2000.
2. Programming with C by K R Venugopal&Sudeep R Prasad, TMH.,1997.
3. The C programming Language by Brian W. Kernighan & Dennis M. Ritchie, Second Edition, Prentice Hall.
4. A Structured Programming Approach Using C by Behrouz A. Forouzan, Richard F. Gilberg, Third Edition, Cengage2007.

Web References: http://cprogramminglanguage.net/http://lectures-c.blogspot.com/

http://www.coronadoenterprises.com/tutorials/c/c_intro.htmhttp://vfu.bg/en/e-Learning/Computer-Basics--computer_basics2.pdf

ME 151	CHEMISTRY LAB	L	T	P	C	Int	Ext
		-	-	3	1.5	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

1. To learn the concepts of equivalent weight, molecular weight, normality, molarity, weight percent, volume percent.
2. To know the methods of determining hardness and chloride ion content of water sample.
3. To learn the redox methods to determine Fe2+ ions present in solution.
4. To know principles and methods involved in using instruments like conductivity bridge and potentiometer
5. To know the molecular properties like surface tension, viscosity.
6. To know synthetic methods for preparation of drugs and polymer

COURSE OUTCOMES:

After successful completion of the course, the students will be able to

1. Determine the Fe(II) content of a given solution and chloride/hardness content of water.
2. Measure conductance of solutions, redox potentials of a cell.
3. Synthesize a small drug molecule and polymer.
4. Measure molecular properties such as surface tension, viscosity and physical parameters like saponification value, partition co-efficient and Rf value.

List of Experiments:

1. Estimation of Mohr's salt using $KMnO_4$.
2. Estimation of Mohr's salt using $K_2Cr_2O_7$.
3. Determination of chloride ion content of water.
4. Determination of Hardness of water using EDTA method.
5. Determination of Fe(II) strength using $K_2Cr_2O_7$ potentiometrically.
6. Determination on strength of NaOH using HCI conductometrically.
7. Determination of surface tension.
8. Determination of Viscosity.
9. Determination of Saponification / acid value of oil.
10. Preparation of p-bromoacetanilide.
11. Preparation of Phenol Formal dehyderesin.
12. Determination of partition co-efficient of I2 in water.
13. Determination of Rf value using TLC.
14. Verification of Freundlich isotherm using adsorption of acetic acid on activated charcoal.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

ME 152	ENGLISH LANGUAGE COMMUNICATION SKILLS LAB	L	T	P	C	Int	Ext
		-	-	3	1.5	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

1. To Identify speaker's purpose and tone; make inferences and predictions about spoken discourse, discuss and respond to content of a lecture or listening passage orally and/or in writing.
2. To acquaint the students with the Standard English pronunciation, i.e., Receive Pronunciation (RP), with the knowledge of stress and intonation.
3. To develop production and process of language useful for social and professional life.
4. To develop in them communication and social graces necessary for functioning. Improve the dynamics of professional presentations.
5. To develop critical reading and comprehension skills at different levels.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Analyze relationships between ideas and formulate inferences and predictions about spoken discourse.
2. Demonstrate accurate pronunciation in spoken English with proficiency.
3. Employ appropriate speech dynamics in various professional situations.
4. Utilize effective strategies and social graces to augment the effectiveness of communication.

List of Exercises / Activities:

Oral Communication (This unit involves interactive practice sessions in Language Lab).

1. Listening Comprehension.
2. Pronunciation, Intonation, Stress and Rhythm.
3. Common Everyday Situations: Conversations and Dialogues.
4. Interviews.
5. Formal Presentations.
6. Reading Comprehension.

REFERENCE BOOK(S) :

1. Communication Skills. Sanjay Kumar and PushpaLata. Oxford University Press.
2. Practical English Usage. Michael Swan. OUP. 1995Press
3. Exercises in Spoken English. Parts. I- III. CIEFL, Hyderabad. Oxford University
4. Technical English .M. Sambaiah, Wiley Publications, New Delhi

ME 153	WORKSHOP PRACTICE LAB	L	T	P	C	Int	Ext
		1	-	4	3	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

Engineers, whatever be their line of activity, must be proficient with all aspects of manufacturing, however it should not be forgotten that practice without theory is blind and the theory without practice is lame.

1. Students involved in acquiring manufacturing skills must have balanced knowledge of theory as well as practice.
2. Imparts basic knowledge of various tools and their use in different sections of manufacture such as fitting, carpentry, tin smithy, moulding, casting, welding, electrical wiring, PCB work on electronic circuits and practice with machine shop tools &equipment's.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to

1. Identify different manufacturing processes which are commonly employed in the industry to fabricate components using different materials.

Lectures and Videos: [10 hours]

1. Manufacturing Methods: Introduction to various types of manufacturing methods-casting-forming
   - various machining operations such as turning, milling, shaping, drilling, slotting etc.,,
   - various joining methods such as welding, brazing, soldering etc.,- Advanced manufacturing methods (3 Lectures).
2. CNC machining and Additive manufacturing (1Lecture).
3. Fitting operations and power tools (power hack saw, table mounted circular saw, wood turning lathe, bench grinder, concrete mixer, concrete vibrator etc.,) (1Lecture).
4. Basic principles involved in electrical circuits and electronic PCB circuits(1Lecture).
5. Carpentry (1Lecture).
6. Welding(arc welding & gas welding) (1Lecture).
7. Metal casting(1Lecture).
8. Plastic moulding, glass cutting (1Lecture).

Text book:

1. HajraChoudhury S, K., HajraChoudhury A.K and Nirjhar Roy S.K. - Elements of Workshop Technology, VolumeI and Volume II,2010, Media promoters and publishers private limited, Mumbai.

Reference books:

1. Kalpakjian S and Steven S.Schmid. - Manufacturing Engineering and Technology, 4th edition, Pearson Education, India,2002.
2. Rao P.N. - Manufacturing Technology, Volume I &II, Tata McGrawHill House,2017.

Work shop Practice: (40 hours)

Objectives:

Students acquiring practical knowledge on various manufacturing techniques and will be able to fabricate components with their own hands.

Outcomes:

Up on completion of laboratory, students will be able to

1. Identify workshop tools and their operational capabilities
2. Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding
3. Apply fitting operations in various applications
4. Apply basic electrical engineering knowledge for House Wiring Practice

List of Exercises - Trade wise Experiments:

1. Welding shop(both arc &gas welding)
   - Square butt joint
   - Lap joint
   - Single v butt joint
   - Gas welding &Cutting
2. Fitting Shop & Casting
   - Inclined fit
   - Half round fit
   - Vfit
   - Moulding and casting of Hand wheel
3. Practice on electrical wiring and Electronic circuit boards
   - One bulb controlled by one switch &one bulb controlled by two switches
   - Two bulbs controlled by one switch (Stair case connection)
   - Tube light connection
   - Measurement of resistance, voltage and current with the help of a multi-meter & soldering on an electronic PCB circuit.
4. Machine Shop
   - Practice of machining operations on Lathe, Milling, Shaping, Drilling and Slotting Machines.
5. Carpentry
   - Lap joint
   - Cross lap joint
   - Dovetail joint
   - Turning on wood turning Lathe
6. Tin Smithy
   - Rectangular tray
   - Funnel
   - Pipe joint
   - Rectangular Scoop

Plastic moulding and glass cutting

Note: A minimum of 2 (Two) from each trade – Total 12 (Twelve) experiments- have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

ME 154	PROGRAMING FOR PROBLEM SOLVING LAB	L	T	P	C	Int	Ext
		-	-	3	1.5	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

1. To understand the basic problem-solving process using Flow Charts and algorithms.
2. To understand the basic concepts of control structures in C.
3. To learn concepts of arrays, functions, pointers and Dynamic memory allocation in C.
4. To use the concepts of structures, unions, files and command line arguments in C.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Develop algorithms and flow charts for simple problems.
2. use suitable control structures for developing code inC.
3. Design modular programs using the concepts of functions and recursion.
4. Develop code for complex applications using structures, pointers and file handling features.

List of Exercises / Activities:

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the given problem using the following statements]

Lab 1 Simple computations using arithmetic expressions.

Lab 2 if-then-else & switch statement

Lab 3 Iterative statements.

Lab 4 1D Array manipulation.

Lab 5 2D Arrays and Strings.

Lab 6 Function calling mechanisms(Call by value).

Lab 7 Function calling mechanisms(Call by reference).

Lab 8 Recursive functions.

Lab 9 Dynamic Memory Allocation.

Lab 10 Structures and Unions.

Lab 11 File Operations.

Lab 12 Command Line Arguments.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

MEMC1	ENVIRONMENTAL SCIENCE	L	T	P	C	Int	Ext
	[MANDATORY NON-CREDIT COURSE]	2	-	-	-	100	-
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

To enable the students to

1. Understand that humans are an integral part of environment and hence their activities reflect on the environment.
2. Realize and appreciate the importance of ancient practices and their importance in the present times
3. Appreciate the contribution of individuals for the upkeep of environmental standards, in turn help the humans live better.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Evaluate the implications of human activities and thereby promote eco-friendly technologies.
2. Promote awareness among the members of the society for a sustainable environment.
3. Include and give priority to environmental protection in all developmental projects.

AWARENESS ACTIVITIES - SMALL GROUPMEETINGS

I. Source of water for human consumption/activities:
- **a.** collection of information pertaining to water resources and consumption in Andhra Pradesh
- **b.** Water resource on campus: General / Laboratory use and
- **c.** Drinking water - understand the background and adopt judicious management.
- **d.** Recycled water for Gardening – Particularly Lawns.
- **e.** Cut down wastage of electricity in class rooms / labs / hostels etc. by avoiding misuse.

II. After the group meetings and exposure to the local issues and healthy practices, students motivated to make:
- **a.** Posters
- **b.** Slogans/One liners for promoting awareness

III. Lectures from Experts (at least 2 in the course duration)

IV. A walk in the neighborhood to promote a chosen theme on environmental consciousness.

B. ACTUALACTIVITIES

1. Plantation on Campus and on the sides of approach road.
2. Distribution of saplings to the local colony dwellers and encourage plantation.
3. Development of Kitchen garden on campus - Cultivation of at-least leafy vegetables and creepers like cucumber etc. for use in college canteen/hostels etc.
4. Adoption of "NO PLASTICS" on campus.
5. Field trip to gain knowledge of biodiversity, water shed, mining, pollution and other local issues.
6. Preparation of working models for energy generation/transformation etc.

C. THEORY SYLLABUS FORASSESSMENT

Part-I

1. Introduction to Environmental Studies, Scope and Importance.
2. Natural resources Renewable and Non-Renewable; Definition and importance of the following resources in detail: a. Forest b. Water c. Land d. Energy
3. Sustainable development - Concept and Measures.
4. Biodiversity - Definition, Types of Biodiversity, Values and threats to Biodiversity, Conservation of biodiversity, IUCN classification: Endangered, Threatened, Vulnerable, Rare species; Endemic and Exotic species.
5. Climate change - Global warming, Ozone depletion and Acid rain.

Part-II

6. Water shed, water shed management in detail.
7. Solid wastes and Solid waste management.
8. Environmental Legislation, Environmental acts - Wild life protection act, Water act, Forest conservation act, Air act and Environmental protection act.
9. Case studies: Chernobyl nuclear disaster, Bhopal gas tragedy, Narmada bachao-andolan, Silent valley, Story of Tuvalu, Story of Ganga.
10. Earth summit and Kyoto protocol; Measures at individual level for conservation of natural resources and sustainable development.

Text Books

1. AnubhaKaushik and C.P.Kaushik - Environmental Studies, 3rd Edition, New Age International Publishers, New Delhi., 2012.
2. R. Rajagopalan - Environmental studies from crisis to cure, 3rd Edition, Oxford University press, 2012.

ASSESSMENT

1. Two assessments each of 40 marks will be done in the semester. The split up of each assessment is as follows:
   a. Two internal theory examinations will be conducted for 18 marks each.
   b. Evaluation of the prepared activity sheets and working models will be done for 12M (continual evaluation) twice in the semester in line with the theory examination.
   c. 5 Marks for attendance and 5 marks for oral test.

Note: Weightages for a, b & c will be taken as per the assessment guidelines of the R-18 curriculum and projected to 100 marks.

ME/CE/EC 121	MATHEMATICS-II	L	T	P	C	Int	Ext
	(Calculus, Ordinary Differential Equations and Complex Variable)	2	1	-	3	30	70
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

The objective of this course is to familiarize the prospective engineers with techniques in Multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Solve differential equations.
2. Evaluate multiple integrals and their usage.
3. Integrate vector functions.
4. Solve the problems on differentiation and integration of a complex variable.

COURSE CONTENT:

UNIT **[CO:1] (12)**

Differentials equations of first order-Linear equations, Bernoulli's equation, exact equations, equations reducible to exact equations.

Differentials equations of higher order - Second order linear differential equations with constant coefficients-Method of variation of parameters, Cauchy's homogeneous linear equation and Legendre's linear equation.

UNIT II **[CO:2] (12)**

Multiple Integrals - Double integrals (Cartesian and polar), Change of order of integration, Change of variables Cartesian to polar coordinates.
Area by double integrals, Triple integrals (Cartesian), Volume by triple integrals.

UNIT III **[CO:3] (12)**

Integration of vectors - Line integrals, surface integrals, Green's theorem in the plane (without proof), Stoke's theorem (without proof), Volume integrals, Gauss divergence theorem (without proof).
Complex variables - Differentiation, Cauchy Riemann equations (Cartesian and polar-without proof), analytic functions.

UNIT IV **[CO:4] (12)**

Harmonic functions, finding harmonic conjugate - Milne Thomson method.
Complex integration - Cauchy Integral Theorem (without proof), Cauchy Integral Formula (without proof).

LEARNING RESOURCES:

TEXT BOOK:

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 42nd edition, 2017.

REFERENCE BOOK(s):

1. Erwin Kreyszig - Advanced Engineering Mathematics, John Wiley & Sons,2006.
2. N.P. Bali and Manish Goyal - A text book of Engineering Mathematics, Laxmi Publications, Reprint,2010.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

ME 122	ENGINEERING PHYSICS	L	T	P	C	Int	Ext
	(Waves and Optics)	3	-	-	3	30	70
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

1. To impart knowledge and understanding the basic principles of oscillators.
2. To understand about basic phenomena of mechanical waves in the medium.
3. To understand the basic phenomena of light waves and interference.
4. To understand about diffraction phenomena and basic principles of lasers.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Illustrate physical concepts used in oscillations.
2. Demonstrate the basic phenomena of mechanical waves in medium.
3. Analyze the propagation of light and interference phenomena.
4. Explain the basic concepts of diffraction phenomena and lasers.

COURSE CONTENT:

UNIT I **[CO:1] (12)**

Simple harmonic motion, damped and forced simple harmonic oscillator:

Mechanical and electrical simple harmonic oscillators, complex number notation and phasor representation of simple harmonic motion, damped harmonic oscillator - heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance.

UNIT II **[CO:2] (12)**

Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion:

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching standing waves and their Eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves and speed of sound, standing sound waves.

UNIT III **[CO:3] (12)**

The propagation of light:

Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction, Light as an electro-magnetic wave and Brewster's angle, total internal reflection.

Wave optics: Interference introduction, Stoke`s principle, interference in thin films by reflected light (cosine law),theory of air wedge , Newton's rings, Michelson interferometer and its applications.

UNIT IV **[CO:4] (12)**

Diffraction and Lasers:

Farunhofer diffraction from a single slit, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas laser (He-Ne), solid-state lasers(Neodymium), Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, applications of lasers in science, engineering and medicine.

LEARNING RESOURCES:

TEXT BOOK:

M.N. Avadhanulu, P.G. Kshirasagar - A Text book of Engineering Physics, S. Chand & Company Ltd., 2018.

REFERENCE BOOK(s):

1. Ian G. Main, Oscillations and waves in physics.
2. H.J. Pain, The physics of vibrations and waves.
3. E.Hecht, Optics.
4. A.Ghatak, Optics.
5. O. Svelto, Principles of Lasers.

WEB RESOURCES:

Online course:

ME 123	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER II [FIRST YEAR]						

Course Objectives:

The main objectives of this course are

1. To introduce fundamental laws, basic electrical elements, sources and their characteristics.
2. To develop the ability to apply circuit analysis to AC circuits.
3. To provide students with fundamental concepts on the construction and operation of transformers and electrical machines.
4. To know the principle of operation and characteristics of diode, transistors and oscillators.

Course Outcomes:

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

1. Explain the basic electrical circuits and batteries.
2. Demonstrate the concept of AC circuits.
3. Discuss the operation of electrical machines.
4. Differentiate diodes, transistors and oscillators.

COURSE CONTENT:

UNIT I[CO:1] (12)

DC Circuits: Batteries: Lead-acid, Nickel-iron, Nickel-Cadmium batteries (Operation only). Elementary calculations for energy consumption. DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, The venin and Norton Theorems.

UNIT II [CO:2] (12)

AC Circuits: Representation of sinusoidal waveforms, peak and rms values of sinusoidal waveform, phasor representation. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), real power, reactive power, apparent power, power factor. Three phase balanced circuits, voltage and current relations in star and delta connections (balanced loads only). Working principle of single-phase transformer, ideal and practical transformer

UNIT III[CO:3] (12)

Electrical Machines: Construction, working principle of DC generator and motor (Elementary treatment only), torque-speed characteristic of separately excited dc motor. Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Construction and working of synchronous generators.

UNIT IV[CO:4] (12)

Semiconductor Diodes: Semiconductor diode, Zener diode, Half-Wave Rectifier, Full-Wave rectifier, Bipolar Junction Transistor: Transistor operation, Common base configuration, Common emitter configuration, Common collector configuration. Feedback and Oscillator

Circuits: Feedback concepts, Barkhausen criteria, Phase-Shift oscillator, Wien bridge oscillator, Hartley oscillator, Colpitts oscillator.

TEXT BOOKS:

1. A.Sudhakar and Shyam Mohan SP, Circuits and Networks: Analysis and Synthesis, 3rd Edition, TMH, 2006.
2. B.L.Theraja – Textbook of Electrical technology-S.Chand&Co.
3. Robert Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", 6th Edition, PHI.

REFERENCE BOOKS:

1. MahmoodNahviandJosephEdminister,ElectricCircuits,4thEdition,Schaum'soutlineseries,TMH,2004.
2. Jacob Millman, Christos C.Halkias, "Integrated Electronics", Tata McGraw Hill Publishers.
3. S.Salivahanan, A.Vallavaraj, "Electronic Devices and Circuits", Tata McGraw Hill Publishers

ME 124	ENGINEERING MECHANICS	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

1. Learn and understand the basic principles of mechanics of rigid bodies, various types of force systems in plane and to analyze problems in a simple and logical manner.
2. Learn basic concepts of force systems in space and study centroids of various standard geometrical shapes as well as composite areas and centre of gravity of material bodies.
3. Study the concept of moment of inertia of areas & material bodies and learn computation deflections using virtual work.
4. Learn principles of dynamics and understand the kinematics and kinetics of rectilinear, curvilinear translation, rotation about fixed axis and general plane motion of rigid bodies.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Determine resultant, moment and unknown forces in plane force systems using principles of statics.
2. Find out the forces and moments in spatial force systems using vector approach.
3. Determine the centroids and center of gravity of standard geometric shapes as well as composite areas.
4. Apply the principle of virtual work for simple ideal systems.
5. Calculate the area moment of inertia and mass moment of inertia of standard geometrical shapes as well as composite sections.
6. Solve simple problems in kinematics and kinetics of particles and rigid bodies by using principles of dynamics.

COURSE CONTENT:

UNIT I **[CO:1](12)**

Basic Concepts & Force systems in a plane: Principles of statics, composition and resolution of forces, equilibrium of concurrent forces in a plane, method of projections, Method of moments, Couple, equilibrium of parallel forces in a plane, resultant and equillibrum of general case of forces in a plane, plane trusses-method of joints. **Friction:** Concept of friction, laws of friction, simple contact friction, wedge friction.

UNIT II **[CO:2,3](12)**

Force systems in a space (Using vector notation): Position vector, unit vector, force vector, resultant and equilibrium of concurrent forces in space, moment of a force about a point, moment of a force about an axis.

Centroid and Centre of Gravity: Centroids of simple shapes from first principles, centroids of composite plane figures, centre of gravity of three dimensional bodies (Right circular cone and Hemi sphere).

UNIT III **[CO:4,5](12)**

Virtual Work: Introduction, principle of virtual work, Equilibrium of Ideal systems. **Moment of Inertia:** Area moment of inertia-Definition, Moment of inertia of plane sections from first

principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections, Mass moment inertia of circular plate, Cylinder, Cone and Sphere.

UNIT IV **[CO:6](12)**

Kinematics: Rectilinear translation, Curvilinear translation, Rotation about fixed axis, General Plane motion of rigid bodies.

Kinetics: Rectilinear translation, Work and energy, Impulse momentum, Collision of elastic bodies-direct central impact, Curvilinear translation, Rotation about fixed axis, General plane motion of rigid bodies.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Engineering mechanics by S. Timoshenko, D. H. Young, J V Rao and Sukumar Pati - 5th edition, McGraw Hill Education (India) Private Limited, (For concepts).
2. Engineering mechanics-statics and dynamics by A. K. Tayal - 14th edition, Umesh publications (For numerical problems).
3. Engineering Mechanics by S.S. Bhavikatti, 5th edition, New Age International Pvt. Ltd Publishers.

REFERENCE BOOK(s):

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall.
2. J. L. Meriam and L. G. Kraige, Engineering Mechanics: Dynamics, Wiley,2011.
3. Singers Engineering Mechanics: Statics and Dynamics, K.Vijaya Kumar Reddy and J Suresh Kumar, 3rd Edition SI Units - BSP Books Pvt. Ltd. Publications.
4. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications.

WEB RESOURCES:

1. https://nptel.ac.in/courses/122104015/
2. https://nptel.ac.in/courses/112103109/

ME 125	ENGINEERING GRAPHICS	L	T	P	C	Int	Ext
		1	-	4	3	30	70
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

1. Expose the students to standards and conventions followed in preparation of engineering drawings.
2. Make them understand the concepts of orthographic and isometric projections.
3. Develop the ability of conveying the engineering information through drawings.
4. Make them understand the relevance of engineering drawing to different engineering domains.
5. Develop the ability of producing engineering drawings using drawing instruments.
6. Enable them to use computer aided drafting packages for the generation of drawings.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Outline engineering drawings as per BIS conventions mentioned in the relevant codes.
2. Represent the drawings with the specifications of orthographic concepts.
3. Develop isometric drawings by observing the orthographic projections of simple objects.
4. Analyzing the isometric views of simple objects and convert to orthographic views.
5. Generate computer drawings using CAD software.

COURSE CONTENT:

UNITI [CO1](12)

General: Principles of Engineering Graphics and their significance, usage of drawing instruments, lettering.

Conic sections: Construction of Ellipse, Parabola, Hyperbola and Rectangular Hyperbola. (General method only)

Curves: Cycloid, Epicycloid, Hypocycloid and Involute and Scales

UNITII [CO1,CO2](12)

Method of Projections: Principles of projection - First angle and third angle projection of points, Projection of straight lines inclined to both planes. Traces of lines.

Projections of planes: Projections of planes inclined to both the planes, projections on auxiliary planes.

UNITIII [CO3](12)

Projections of Regular Solids: Projections of solids (Prism, Pyramid, Cylinder and Cone) with varying positions.

Sections of Solids: Sections of Prisms, Pyramids, cylinders and Cones. True shapes of sections.(Limited to the cutting plane perpendicular to one of the principal plane).

Development of surfaces: Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNITIV [CO4, CO5](12)

Isometric Projections: Principles of Isometric projection-Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids

Orthographic Projections: Conversion of pictorial views into Orthographic views and Vice-versa. (Treatment is limited to simple castings).

Perspective Projections: Introduction to Perspective Projection

LEARNING RESOURCES:

TEXT BOOK:

Bhatt N.D., Panchal V.M. & Ingle P.R. - Engineering Drawing, Charotar Publishing House, 2014.

REFERENCE BOOK(s):

1. Shah, M.B. &Rana B.C. - Engineering Drawing and Computer Graphics, Pearson Education,2008.
2. Agrawal B. &Agrawal C. M. - Engineering Graphics, TMH Publication,2012.
3. Narayana, K.L. & P Kannaiah - Text book on Engineering Drawing, Scitech Publishers,2008.
4. (Corresponding set of) CAD Software Theory and User Manuals

ME 161	PHYSICS LAB	L	T	P	C	Int	Ext
		-	-	3	1.5	30	70
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

1. To give background in experimental techniques and to reinforce instruction in physical principles.
2. To find measurement, data, error, or graphical analysis in addition to illustrating a physical principle
3. To give skills that can transfer critical thinking into problem solving methods, how to identify what data is important, how to collect that data and then draw conclusions from it.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to

1. Utilize a CRO, function generator, and spectrometer to conduct measurements.
2. Experiment with optical instruments applying principles of interference and diffraction for testing.
3. Utilize physics lab concepts to execute precise measurements and proficiently handle sensitive equipment.
4. Examine data to draw conclusions and enhance skills in experimental design.

List of Experiments:

1. Some basic measuring instruments: Screw gauge, VernierCallipers, Spherometer, Travelling Microscope etc., & General instructions.
2. To determine the acceleration due to gravity and radius of gyration using compound pendulum.
3. To determine the rigidity modulus of the given wire material using Torsional pendulum.
4. To determine the young modulus of the given material by non uniform bending.
5. To study the characteristic curves of a given Photocell and determine the Planck's constant.
6. To determine the radius of curvature of a given Plano-convex lens by Newton's Rings experiment.
7. To calculate the frequency & amplitude of sinusoidal waves and calibration of a given audio oscillator - Lissajous' Figures.
8. To determine the magnetic field along the axis of circular current carrying coil.
9. To measure the a.c. supply frequency using A.C. sonometer.
10. To determine the quality factor of a given series resonance LCR circuit.
11. To determine Fill factor of a given photo-voltaic cell.
12. To determine the wavelengths of spectral lines of mercury light using diffraction grating.
13. To determine the wavelength of laser using diffraction grating.
14. To find the dispersive power and resolving power of a grating.
15. To determine the magnetic field in Helmoltz coil.
16. To determine the refractive index of the material of a prism.

REFERENCE BOOKS :

1. Students reference manual : Department of physics, RVR & JC College of Engg.

2. Engineering Physics Lab Manual; Dr. C.V.MadhusudhanaRao, V. Vasanth Kumar, 3rd edition, Scitechpublications(India) Pvt. Ltd. Chennai.

3. Engineering Physics Practical's: Dr.B. SrinivasaRao, V.K.V.Krishna, K.S. Rudramamba University Science Press, Daryaganj, New Delhi.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

ME 162	COMPUTER AIDED GEOMETRICAL MODELLING LAB	L	T	P	C	Int	Ext
		-	-	3	1.5	30	70
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

1. Expose the students to standards and conventions followed in preparation of engineering drawings.
2. Enable them to use computer aided drafting packages for the generation of drawings.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Prepare engineering drawings as per BIS conventions mentioned in the relevant codes.
2. Produce computer generated drawings using CAD software.
3. Develop isometric drawings of simple objects reading the orthographic projections of those objects.
4. Convert pictorial and isometric views of simple objects to orthographic views.

List of Experiments:

1. INTRODUCTION to CAD
2. AutoCAD –BASICS
   - Starting with AutoCAD
   - Layout and sketching
   - Drawing environment
   - Elements of drawing
   - Draw tool bar
   - Modify Toolbar
   - Dimension Toolbar
   - View toolbar
3. 2D drawings of various mechanical and structural components
4. Orthographic and Isometric views of mechanical castings and simple structures.
5. 3-D SOLIDS simple shapes, drafting
6. Sectioning of solids and sectional views.

Learning Resources:

1. Mastering AutoCAD 2019 and AutoCAD LT 2019, Book by Brian C. Benton and George Omura, Willey Publications,2018

ME 163	BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB	L	T	P	C	Int	Ext
		-	-	3	1.5	30	70
	SEMESTER II [FIRST YEAR]						

Course Objectives:

The main objectives of this lab course are

1. To conduct experiments on electrical circuits.
2. To design experimental setups for theorems.
3. To learn Diode characteristics, and basic diode applications as rectifiers and regulators.
4. To learn BJT characteristics and Oscillators.

Course Outcomes:

Upon completion of this laboratory, the student will be able to:

1. Examine common electrical components and their ratings.
2. Illustrate the usage of common electrical measuring instruments.
3. Verify the network theorems and Design Zener voltage regulator to meet the specifications.
4. Verify experimentally popular BJT applications such as Amplification.

List of experiments/demonstrations:

1. Familiarization of Electrical Installations and Electrical Testing Equipment: Miniature circuit breakers (MCBs), Moulded Case Circuit Breakers (MCCBs), Earth-leakage circuit breakers (ELCBs), Fuses, Types of Wires, Wire Gauges, continuity test, megger, Cables and Earthing.
2. Basicsafetyprecautions.Introductionanduseofmeasuringinstruments–voltmeter, ammeter, wattmeter, multi-meter, oscilloscope, measurement of basic parameters.
3. Verification of KVL&KCL.
4. Verification of Superposition Theorem.
5. Verification of Thevenin's Theorem.
6. Verification of Norton's Theorem.
7. Determination of choke coil parameters.
8. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
9. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single- phase induction machine.
10. Speed control of dc motor.
11. Torque-Slip Characteristics of an induction motor
12. Characteristics of Silicon, Germanium diodes.
13. Characteristics of Zener diode.
14. Half Wave Rectifier and Full Wave Rectifier.
15. Transistor Characteristics in CE configuration.
16. Wein Bridge Oscillator.
17. Colpitt's Oscillator.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

MEMC2	CONSTITUTION OF INDIA	L	T	P	C	Int	Ext
	[MANDATORY NON-CREDIT COURSE]	2	-	-	-	100	-
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

To provide basic information about Indian Constitution.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Explain the concepts of domicile and citizenship as outlined in the Indian Constitution.
2. Recognize the relevance and importance of Directive Principles of State Policy
3. Identify the structure and functions of the State Executive including the roles of Governors and Chief Ministers, along with the significance of State Legislature and High Courts in the federal structure of India.
4. Analyze the importance in ensuring social justice and equity
5. Analyze the dynamics of Centre-State Relations, including the procedures for constitutional amendments

COURSE CONTENT:

UNIT I **[CO:1, 2] (10)**

Preamble to the Constitution of India Domicile and Citizenship. Fundamental rights under Part III, Leading Cases. Relevance of Directive Principles of State Policy under Part-IV, IV-A Fundamental duties.

UNIT II **[CO:3] (10)**

Union Executive - President, Vice-President, Prime Minister, Union Legislature - Parliament and Union Judiciary - Supreme Court of India. State Executive - Governors, Chief Minister, State Legislature and High Court.

UNIT III **[CO:4] (10)**

Special Constitutional Provisions for Scheduled Casters and Tribes, Women and Children and Backward Classes, Emergency Provisions.

UNIT IV **[CO:5] (10)**

Electoral process, Centre State Relations (Amendment Procedure, 42nd, 44th, 74th, 76th, 86th and 91st Constitutional amendments).

LEARNING RESOURCES:

TEXT BOOK:

Durga Das Basu: "Introduction to the Constitution of India" (student edition) Prentice - Hall EEE, 19th/20th Edition, 2001.

REFERENCE BOOK(s):

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
2. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI, Learning Pvt.Ltd., New Delhi, 2011.

II YEAR

ME 211	OPERATIONS MANAGEMENT	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

1. To know the importance of forecasting and identify various methods available to forecast the sales/demand. Get the knowledge of choosing best location for plants and about and facilities layout
2. Understand types of production systems and about sequencing
3. To learn about the aggregate planning and its methods
4. Discuss the network techniques and features of project management

COURSE OUTCOMES:

1. Apply various concepts and different approaches in forecasting demand
2. Explain the importance of Plant location and facilities layout
3. Distinguish different production systems including their strengths and weaknesses
4. Select the order of jobs to be processed on the machines.
5. Solve Managerial problems of production planning and control related to aggregate, Master Production Schedule, Material requirement planning,
6. Solve the problems of Project Management by CPM and PERT techniques

COURSE CONTENT:

UNIT-1	CO1,2	12
Forecasting: Forecasting variables, forecasting procedure, methods of forecasting: moving average, least squares, simple exponential smoothing, linear regression, correlation coefficient, problems. **Plant Location and Facilities layout:** Necessary factors governing plant location, principles of plant layout, types of layouts.		
UNIT-2	**CO3,4**	**12**
Production systems: Continuous and intermittent production. Mass and flow production, batch production, job order production, production functions. **Sequencing problem :** Introduction, Processing n jobs through 2 machines, Processing n jobs through 3 machines, processing 2 jobs through m machines, problems		
UNIT-3	**CO5**	**12**
Aggregate planning and scheduling : Long range, intermediate range and short range plans, the aggregate planning problem, aggregate planning methods, mathematical planning models, theoretical planning models (LDR) and heuristic and computer search models, problems. **Master scheduling:** Master scheduling formation: inputs and outputs, Master scheduling methods		
UNIT-4	**CO6**	**12**
Project Planning through networks: Arrow (Network) diagram representation, rules for constructing an arrow diagram, PERT, CPM, Critical path calculations, Determination of critical path, Determination of floats, Probability considerations in project. Introduction to Crashing.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Operations Management – Joseph G.Monks, Tata McGraw Hill
2. Production and Operations Management by Stevenson , Irwin Professional Publishing

REFERENCE BOOK(S):

1. Operations Research – R.Pannerselvem, PHI, 2ndedition,2006.
2. PERT and CPM : Principles and applications-L.S.Srinath.
3. Production and Operations Management by S.N.Chary, TMH

ME 212	MATERIAL SCIENCE AND METALLURGY	L	T	P	C	Int	Ext
		3	0	-	3	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

1. To understand of the correlation between the internal structures of materials, their mechanical Properties and various methods to quantify their mechanical integrity and failure criteria.
2. To provide a detailed interpretation of equilibrium phase diagrams
3. To learn about heat treatment methods to tailor the properties of Fe-C alloys.
4. To introduce various materials related to properties and applications

COURSE OUTCOMES:

1. Summarize the knowledge about various crystal structures and their importance in Mechanical Properties and Testing
2. Distinguish various phase diagrams in a binary systems outlining their significance in metal solubility
3. Identify the purpose of heat treatment and Concept of heat treatment processes.
4. Infer various materials in terms of its properties and applications.

COURSE CONTENT:

UNIT-1	CO1	12
Crystal structure Unit cells, Crystal structures, Atomic Packing Factors, Coordination Numbers, Imperfection in solids: Point, line, interfacial and volume defects; Slip and Twinning, critically resolved shear stress. **Materials and Properties** Classification of materials and their usage in various fields, Testing and evaluation of properties Mechanical Properties of materials. Tensile Testing, Compression Testing, Hardness Testing, Impact Testing and an introduction to Non Destructive Testing (NDT)		
UNIT-2	**CO2**	**12**
Constitution of Alloys and Phase diagrams, Necessity of Alloying, Types of Solid Solutions ,Gibbs Phase Rule , Hume-Rothery's Rules, Lever rule, Phase Diagrams - Isomorphous, Eutectic, Eutectoid , Partial eutectic, peritectic and Monotectic systems Iron–carbon system Iron transformations in the solid state – allotropy and Iron-Iron Carbide Phase Diagram and related phases,		
UNIT-3	**CO3**	**12**
Heat Treatment of Steels: TTT diagrams for eutectoid, hypo and hyper eutectoid steels, martensite and bainitic transformation. Heat Treatment methods: Introduction and purpose of heat treatment, Annealing, Normalizing, Hardening, Tempering, Austempering ,Martempering, Age hardening and Surface Hardening of Steels.		
UNIT-4	**CO4**	**12**
Ferrous Alloys: Types, Properties, applications of Steels & Cast irons. Non-ferrous alloys: Properties and applications of Copper, Aluminium and its alloys, Super alloys **Composite Materials:** Properties and applications of Particulate reinforced composites, fibre reinforced composites, laminar composites and metal matrix composites **Powder Metallurgy:** Powder metallurgy process, preparation of powders, Applications.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Material Science and Metallurgy - Dr.V.D.Kodgire, Everest Publishers ,2008.
2. Introduction to Physical Metallurgy - Avner, McGrawHill , 2nd Edition,1997
3. Material Science and Metallurgy - V. Raghavan, Pearson Education / PHI, 5th Edition, 2004.

REFERENCE BOOK(S):

1. Material Science and Metallurgy - R.B.Choudary - KhannaPub , 1stEdition.
2. A Text Book of Material Science and Metallurgy , O.P. Khanna , DhanapatRai Publiacations,2012.

ME 213	MANUFACTURING PROCESS	L	T	P	C	Int	Ext
		3	0	-	3	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

To motivate and challenge students to understand and develop an appreciation of the processes

1. To impart basic knowledge and understanding about casting processes
2. To impart basic knowledge for various bulk metal forming processes
3. To impart basic knowledge for various sheet metal forming and HERF processes
4. To understand various welding processes and additive manufacturing techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Describe the fundamentals of metal casting and special casting processes
2. Explain the fundamentals of bulk deformation processes
3. Differentiate varieties of sheet metal forming operations
4. Describe various joining and additive manufacturing techniques.

COURSE CONTENT:

UNIT-1	CO1	12
Metal Casting: Casting and moulding: Introduction to Casting, terminology, Pattern-types, materials and allowances, moulding sand properties. Elements of gating system for castings, Riser design- Caine's method, and modulus method-Problems. Melting furnace: Cupola and its Zones **Special casting processes:** Centrifugal casting, Die Casting-Types with related equipment, Investment Casting, Casting defects and Remedies.		
UNIT-2	**CO2**	**12**
Introduction to bulk metal forming: Fundamentals of hot and cold working processes. Rolling-types of roll mills and passes, load estimation for rolling simple problems. **Extrusion**: Characteristics, Types of extrusion, Impact extrusion, Hydrostatic extrusion-load estimation and simple problems. **Forging:** Types of forging, forging operations, load estimation..		
UNIT-3	**CO3**	**12**
Sheet metal forming - Blanking and piercing, Forces and power requirement in these operations, shear, die deign–simple problems. Drawing, number of draws, drawing dies design – simple problems. Stretch forming, Bending, Spring back effect, types of bending, Coining, Spinning, Types of presses and press tools. **High energy rate forming processes**: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.		
UNIT-4	**CO4**	**12**
Joining/fastening processes: Welding, Classification of welding processes, types of welded joints and their characteristics. Arc welding, TIG,MIG, submerged arc welding, electro slag welding. Gas welding, and resistance welding process and types-Simple problems. Solid-liquid state joining processes- Brazing, soldering and adhesive bonding. Ultrasonic welding, laser beam welding, friction stir welding, explosive welding, welding defects and remedies		

Additive manufacturing:
Introduction to Rapid prototyping-Need, types- SLS, FDM, advantages, limitations and applications.

LEARNING RESOURCES:

TEXT BOOK(S):

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)- Pearson India, 2014.
2. Workshop Technology by HazraChaudharyvol I &vol II , Media Publishers & Promoters, India
3. Production Technology Vol 1 and 2 by R.K. Jain ,Khanna Publishers , Edn. 19 ,Delhi

REFERENCE BOOK(S):

1. Degarmo, Black &Kohser, Materials and Processes in Manufacturing.
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems.

WEB REFERENCE:

1. https://nptel.ac.in/courses/112104195/1
2. https://nptel.ac.in/courses/112107144/13

ME 214	BASIC THERMODYNAMICS	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

1. To learn about Thermodynamic system types and examples, work and heat interactions, and balance of energy between system and its surroundings.
2. TolearnaboutIlawofthermodynamicsappliedtoclosedandopensystemsandapplicationtovarious engineering devices.
3. To understand the concepts of heat engine, refrigerator and heat pump and know the rate of conversion of heat into work and calculate Thermal Efficiency and COP.
4. To learn about II law of thermodynamics and Entropy concepts and to understand how much amount of energy can be Available for conversion into useful work and the concepts of Irreversibility and know about the concept of air standard efficiency and working of different important air standard cycles.

COURSE OUTCOMES:

1. Determine the work and heat interactions in non-flow systems, undergoing different processes through the knowledge of fundamentals of thermodynamics.
2. Calculate heat, work, internal energy, and enthalpy for a thermodynamic system undergoing different processes by the first law of thermodynamics.
3. Determine the performance of the heat engine, refrigerator, and heat pump by the Second law of thermodynamics and entropy change for various systems.
4. Calculate the exergy and irreversibility for different systems and air standard thermal efficiency of Otto, Diesel, and Dual cycles.

COURSE CONTENT:

UNIT-1	CO1	12
FUNDAMENTALS: System & Control volume; Property, State & Process; Exact & Inexact differentials; Temperature, Definition of thermodynamic equilibrium and Zeroth law; Temperature scales; Various Thermometers-Temperature measurement. **WORK & HEAT:** Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, gravitational, spring and shaft work-- Definition of heat; examples of heat/work interaction in systems.		
UNIT-2	**CO2**	**12**
FIRST LAW OF THERMODYNAMICS FOR NON-FLOW PROCESSES: First law applied to a cycle and to a process, Concept of total energy E; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy. **FIRST LAW FOR FLOW PROCESSES:** Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; I law applications for system and control volume.		
UNIT-3	**CO3**	**12**
SECOND LAW OF THERMODYNAMICS: Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale. **ENTROPY:** Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of entropy change for different non flow processes- Principle of increase of entropy; Illustration of processes in T-s coordinates.		

UNIT-4	CO4	12
AIR STANDARD CYCLES: Otto, Diesel and Dual cycles- Analysis for thermal efficiency and mean effective pressure, comparison between Otto, Diesel and Dual cycles. **AVAILABILITY AND IRREVERSIBILITY:** Available and Unavailable energies, Irreversibility and Availability, Availability function for systems and Control volumes, Lost work.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Engineering Thermodynamics- Nag, P.K, 2005, Tata McGraw-Hill Publishing Co.Ltd.
2. Thermal Engineering- M.M. Rathore, McGrawHill,2010.

REFERENCE BOOK(S):

1. Thermal Engineering - Er. R.K. Rajput, Lakshmi Publications,2010.
2. Treatise on Heat Engineering - V.P.Vasandhani and D.S. Kumar, 4th Edition Metropolitan Book Co. Pvt Ltd.

WEB REFERENCE:

1. https://nptel.ac.in/courses/112/105/112105123/
2. https://www.coursera.org/learn/thermodynamics-intro
3. http://web.mit.edu/16.unified/www/FALL/thermodynamics/thermo.pdf

ME 215	THEORY OF MECHANISMS & MACHINES	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

1. To provide basic concepts on mechanisms, machines.
2. To analyze the velocities of various links in mechanisms.
3. Brief study on synthesis of mechanisms and working principles of CAM power elements.
4. To introduce various concepts on gears and gear trains.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Identify various machines, mechanisms, and related terminologies.
2. Determine the displacement, velocity and acceleration at any point in a moving link of a given mechanism.
3. Describe the concepts of synthesis a mechanism.
4. Draw the profile of cam with different followers and motion.
5. Analyze the mechanism of gears and gear trains comprehensively.

COURSE CONTENT:

UNIT-1	**CO1**	**12**
Introduction: Mechanisms and machines, Rigid and resistant bodies, Link, Kinematic pair, Degrees of Freedom, Classifications of Kinematic pairs, kinematic-chain, Linkage, Mechanism, and structure, Classification of mechanisms, Equivalent Mechanisms, Four - Link (bar) Mechanism, Inversions of Slider - Crank Chain, Double - Slider Chain. Straight Line Mechanisms: Hart Mechanism, Scott Russel Mechanism, Grass Hoper Mechansim. **Velocity Analysis:** Introduction, Absolute and Relative Motion, Addition and subtraction of Vectors, Motion of a Link, Four Link Mechanism, Angular Velocity of Links, Velocity of Rubbing, Slider – Crank Mechanism, Crank and Slotted Lever Mechanism.		
UNIT-2	**CO2**	**12**
Instantaneous centre: Notation, Number of I - Centers, Arnold Kennedy's theorem, Locating I - Centres, Angular velocity by I - Centre Method. **Acceleration Analysis:** Acceleration, Four-Link Mechanism, Angular acceleration of Links, Acceleration of Intermediate and offset points, slider- Crank Mechanism, Coriolis component acceleration, Crank and slotted lever Mechanism.		
UNIT-3	**CO3, CO4**	**12**
Kinematic Synthesis: Stages of synthesis-Concepts of type, Number and dimensional synthesis - Tasks of dimensional synthesis, Concepts of function generation, Rigid body guidance and path generation, Freudenstein's equation for function generation using three precision points. **Cams:** Introduction, Types of cams, Types of Followers, Definitions, Graphical synthesis of cam profile. (Knife Edge, Roller and Flat faced Followers).		
UNIT-4	**CO5**	**12**
Gears: Introduction, Classification gear terminology, Law of Gearing, Velocity of Sliding, Forms of Teeth, Cycloidal Profile Teeth, Involute Profile Teeth, Path of contact, Arc of		

contact, Number of pairs of Teeth in contact, Interference in Involute Gears, Minimum number of Teeth, Interference between Rack and Pinion, Undercutting, Comparison of Cycloidal and Involute tooth forms.
Gear Trains: Introduction, simple Gear Train, Compound Gear Train, Reverted Gear train, Planetary or Epicyclic Gear Train, Analysis of Epicyclic Gear Train, Torques in Epicyclic Trains: Tabular Methods.

LEARNING RESOURCES:

TEXT BOOK(S):

1. Theory of Machines of by S.S.Rattan. TMH, second re print ,2009.
2. Theory of Mechanisms and Machines by Ghosh and Mallik , East West Press, New Delhi,Re print2000.

REFERENCE BOOK(S):

1. Theory of Mechanisms and Machines by C.S.Sharma, KamleshPurohit, PHI ,2006.
2. Theory of Mechanism and Machine by J.E. Shigley, MGH , 2ndEdition.

WEB REFERENCE:

1. http://nptel.iitk.ac.in
2. http://ptumech.loremate.com/tom1/node/1
3. http://www.youtube.com/watch?v=6coD3oOuhr8

ME 251	MACHINE DRAWING LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

1. To make the students understand the concepts of sectioning & method of representing full & half sectional views of various symmetrical & asymmetrical components.
2. To make the students understand the nomenclature associated with screw threaded fasteners, methods to represent and drawing of internal as well as external screw threads.
3. To make the students understand the uses of keys, cotters & pins temporary joints possible between two shafts or shaft &hub.
4. To make the students understand and draw assemblies of machine parts and to draw their sectional views and also to make them familiar with the part drawings and views of assembled component.

COURSE OUTCOMES:

After the successful completion of the course, students are able to

1. Analyse the cross-section of machine components from its sectional views.
2. Classify various screw threads and bolted joints.
3. Draw different types of keys and cotter joints.
4. Sketch assembly and part drawings for various machine components from individual components of machine.

LIST OF EXPERIMENTS:

1. Sectional views: Introduction, full & half section
2. Screwed fasteners: Screw thread nomenclature - types & classification of screw threads, Square & Hexagonal headed bolted joints.
3. Keys, Cotters and Pin joints: Saddle & Sunk Keys, Cotter Joint with sleeve , Knuckle Joint
4. Assembly Drawings and Part Drawings: Stuffing Box , Screw Jack , Eccentric , Pipe – Vice (Assembly), Plummer Block, Tail Stock and Tool Post (Part Drawing).

LEARNING RESOURCES:

TEXT BOOK(S):

1. Machine Drawing by K.L.Narayana, P.Kannaiah&K.Venkata Reddy, New Age International , 3rd Edition
2. Machine Drawing- N. Siddeswar, K. Kannaiah& V.V.S. Sastry-TMH.

REFERENCE BOOK(S):

1. Machine Drawing by K.R.Gopala Krishnan, Subhas Publications, 20th Edition,2007.
2. A Text book on Machine Drawing by R.K.Dhawan, S. Chand & Company Pvt. Ltd. 2014edition.

WEB REFERENCE:

1. https://nptel.ac.in/courses/112106075/

ME 252	MODELLING LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

1. To provide the students with the knowledge and techniques of the research and application of CAD/CAM.
2. To create 3D part geometry using the design module of the modeling
3. To develop the skills in CAD operations to visualize and create three dimensional part models of mechanical components and assemblies.
4. Student will be able to produce CAD drawings which communicate the appropriate manufacturing details, standards, and specifications

COURSE OUTCOMES:

1. Draw complex 2D models of machine components using sketcher module.
2. Create 3D models of engineering components using solid, surface and wireframe modeling techniques.
3. Build complex engineering assemblies using appropriate assembly constraints like coincidence, surface and angle constraints etc.
4. Develop a basic virtual automation system for assembly of industrial products

LIST OF EXPERIMENTS:

1. Sketcher: Creation of sketch profile with constraints, Transformations, Project 3DElements, Sketch Analysis, Practice of different sketches
2. Part Modeling: Creating Sketch Based features, Creating Dress-up based features, Draft & Draft Analysis
3. Assembly Modeling: Assembly Constraints, Engineering Connections, Insert new product or part, BI Essentials, Interference Analysis
4. Generative Shape Design: Creation of 3D Elements, Creation of offset, Creation technique of Multi-section, Sweep and Blend. Split and Trim operations, Join, Extract.
5. Process Planning: Creating Systems & operations, Apply flow between Operations. Plant Equipment allocation: Creating Manufacturing Cells and Stations, Insert storage Transpiration and industrial resources Note: 3D modeling using any of the modeling packages like 3D Experience/CATIA, Pro/ ENGINEER, Uni- Graphics, Solid Works, Ideas, Auto Desk Inventor etc.

**Parts and Assemblies can be chosen from Textbook

LEARNING RESOURCES:

TEXT BOOK(S):

4. Bhatt N.D., Panchal V.M. & Ingle P.R. - Engineering Drawing, Charotar Publishing House,2014.
5. "Machine Drawing" by K. L. Narayana, P. Kannaiah, K. Venkata Reddy , New Age International ,2007.
6. “CAD Modeling Essentials in 3DEXPERIENCE 2016x Using CATIA Applications”,NadarZamani, 2017

WEB REFERENCE:

4. https://edu.3ds.com/en/learn-online

ME 253	ADVANCED PROGRAMMING LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

The course is designed to

1. To illustrate operations of linear and non-linear data structure
2. To demonstrate computational problems using suitable data structures
3. To familiarize design strategies to solve complex problems

COURSE OUTCOMES:

After the successful completion of the course, students are able to

1. Demonstrate operations on linear and non-linear data structures
2. Build the algorithm using various data structures
3. Develop solution for the given problem using data strucutres.

List of Experiments to implement:

1. List ADT
2. Applications of List
3. Single Circular List ADT
4. Doubly Linked List ADT
5. Stack ADT
6. Applications on Stack
7. Queue ADT
8. BST ADT
9. Graph traversal techniques
10. Divide and Conquer strategy
11. Greedy Strategy
12. Dynamic Programming
13. Back tracking Strategy
14. Branch and Bound

Note:**

Not limited to these programs only, if necessary, the teacher can include some more applications based on his/her perception.

MESL1	DATA STRUCTURES AND ALGORITHMS	L	T	P	C	Int	Ext
	SKILL ORIENTED COURSE	1	0	2	2	100	--
	SEMESTER III [SECOND YEAR]						

Course Objectives:

1. To design and implementation of various basic and advanced data structures.
2. To introduce various techniques for representation of the data in the real world.
3. Acquaintance of algorithm design strategies.
4. Expertise with a variety of significant algorithms

Course Outcomes

After completion of the course, the students will be able to

1. Implement Appropriate Linear data structures as applied to specified problem definition.
2. Implement Non-Linear data structures to develop solutions for complex problem using Divide and Conquer.
3. Develop solutions for complex problems using Greedy and Dynamic Programming.
4. Design all possible solutions for a problem using Backtracking and Branch and Bound

COURSE CONTENT:

UNIT-1	CO1	12
Analysis of an Algorithm, Asymptotic Notations, Singly Linked lists - Representation in Memory, Abstract Data Types (ADTs) - singly linked lists, doubly - linked lists and circularly linked lists. Stack ADT and its operations using array and linked list, Queue ADT and its operations using array and linked list.		
UNIT-2	**CO2**	**12**
Basic Tree Terminologies, Different types of trees: Binary Tree, Binary Search Tree, tree traversals, Graph representation and traversals. Divide and Conquer - Control Abstraction, Merge sort, Quick sort, Binary Search.		
UNIT-3	**CO3**	**12**
Greedy Method - Control Abstraction, Knapsack Problem, Minimum Cost Spanning Trees, Single Source Shortest Paths. Dynamic Programming - General Method, Multi-stage Graph, All Pairs Shortest Paths, String Editing, Single Source Shortest Paths (General Weights).		
UNIT-4	**CO4**	**12**
Backtracking - General Method, 8-Queens Problem, and Graph Coloring. Branch and Bound – General Method, Travelling Sales Person Problem, Knapsack problem.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,1997.
2. E. Horowitz, S. Sahni and S.Rajsekaran, "Fundamentals of Computer Algorithms", Galgotia Publication.

REFERENCE BOOK(S):

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill,2002.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearsonducation,1983.

MEMC3	PROFESSIONAL ETHICS & HUMAN VALUES	L	T	P	C	Int	Ext
	MANDATORY COURSE	2	0	0	0	100	--
	SEMESTER III [SECOND YEAR]						

Course Objectives:

1. To create awareness to specific set of morals, values and ethics the professional must know and abide by, including work ethics, integrity and commitment etc.
2. To realize the importance of moral autonomy, professional ideals and Ethical theories
3. To study safety/risk aspects, welfare of the public and about employee rights
4. Know about the global issues and code of ethics of professional bodies

Course Outcomes

After completion of the course, the students will be able to

1. Demonstrate morals, values, ethics and human values
2. Explain moral autonomy, norms of professional ideals and ethical theories
3. Differentiate safety, risk, various attributes of professional and employee rights
4. Interpret various global issues and codes of some professional bodies

COURSE CONTENT:

UNIT-1	CO1	12
Human Values : Morals, Values And Ethics - Integrity- Work Ethics- Service Learning - Civic Virtue Respect For Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time -Co- Operation - Commitment - Empathy - Self-Confidence - Character - Spirituality.		
UNIT-2	**CO2**	**12**
Engineering Ethics: Senses of Engineering Ethics- Variety of Moral Issues - Types of Inquiry - Moral Dilemmas - Moral Autonomy - Kohlberg's Theory - Gillian-s Theory - Consensus and Controversy **Professions and Professionalism:** The nature and characteristics of Professions, Professionalism, the foundation and norms of Professional ethics, the need for separate code of conduct for Professionals, Professional Rights, Theories about Right Action, Uses of Ethical Theories. Case studies like The Space Shuttle Challenger, Bhopal gas tragedy, Chernobyl disaster etc.		
UNIT-3	**CO3**	**12**
Engineering as Social Experimentation: Engineering As Experimentation - Engineers As Responsible Experimenters Safety, Responsibilities and Rights: Safety and Risk - Assessment of Safety And Risk - Risk Benefit Analysis and Reducing Risk. Collegiality And Loyalty - Respect For Authority –Collective Bargaining - Confidentiality - Conflicts Of Interest - Occupational Crime - Employee Rights – Intellectual Property Rights (IPR) - Discrimination.		
UNIT-4	**CO4**	**12**
Multinational Corporations - Environmental Ethics - Computer Ethics - Business ethics - Engineers As Managers - Consulting Engineers - Engineers As Expert Witnesses and Advisors - Codes Of Ethics - Sample Code Of Ethics Like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management Etc.,		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Mike martin and Ronald Schinzinger, "Ethics in Engineering" McGraw-Hill, New York1996
2. Govindarajan M, Natarajan S, Senthil Kumar V.S., "Engineering Ethics", PHI, NewDelhi
3. Bayles.M.D, Professional ethics, California, Wards worth publishingcompany,1981

4. Koehn.D, The ground of Professional Ethics, Routledges,1995

REFERENCE BOOK(S):

1. Charles D,Fleddermann, "Engineering Ethics", Pearson / PHI, New Jersey 2004 (Indian Reprint)
2. Charles E Harris, Michael S.Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases" Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, "Ethics and the conduct of business" Pearson, New Delhi,2003.
4. Edmund G.Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers" Oxford University Press, Oxford,2001.

ME 221	MATHEMATICS - III (PDE, Probability & Statistics)	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER IV [SECOND YEAR]						

Course Objectives:

1. To provide knowledge on partial differential equations and its applications in engineering.
2. To provide knowledge on numerical methods including solving systems of linear equations and interpolation.
3. To provide knowledge on numerical integration, numerical solution of ordinary and partial differential equations.
4. To provide knowledge on probability distributions and testing of hypothesis.

Course Outcomes:

After successful completion of the course, the students are able to

1. Solve first and second order partial differential equations in engineering applications.
2. Solve system of equations using numerical techniques.
3. Solve integrals, ordinary and partial differential equations using numerical techniques.
4. Apply knowledge of distribution theory and testing of hypothesis for engineering problems.

COURSE CONTENT:

UNIT-1	**CO1**	**12**
Partial Differential Equations and Applications: Definition, Linear equation of the first order, classification of second order linear equation and its solution by method of separation of variables, Solution of one dimensional wave equation. Solution of one dimensional heat equation, Solution of two dimensional heat equation in steady state (Cartesian only).		
UNIT-2	**CO2**	**12**
Numerical Solution of Equations, Interpolation and Numerical differentiation: Newton-Raphson method, Gauss Seidel iteration method, forward and backward differences, differences of a polynomial, Newton's Forward and Backward Interpolation formulae (without proof). Lagrange's Interpolation formula (without proof), Inverse interpolation. Newton's forward and backward differences formula to compute first and second order derivatives.		
UNIT-3	**CO3**	**12**
Numerical Integration, Numerical Solution of Ordinary and Partial Differential Equations: Trapezoidal rule, Simpson's one-third rule and three-eight rules (without proof) Euler's method, Runge-Kutta method of fourth order, Laplace's equation and Poisson's equation.		
UNIT-4	**CO4**	**12**
Probability Distributions & Testing of Hypothesis: Binomial distribution, Poisson distribution, Normal distribution and their applications. Test for single mean (t-test), test for two means (t-test), Test for ratio of variances (F-test), Chi-square test for goodness of fit for Binomial and Poisson distributions and independence of attributes.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43nd edition, 2015.

2. Richard A. Johnson., Miller & Freund's, Probability and Statistics for Engineers, PHI, 6th Edition.

REFERENCE BOOK(S):

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,2010.
3. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited, 5th edition, 2012.
4. S. Ross, A First Course in Probability, 6th Edition, Pearson Education India,2002.

WEB REFERENCE:

http://nptel.iitm.ac.in/courses/

ME 222	APPLIED THERMODYNAMICS	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. To enable the student to understand what is a pure substance what are its properties and know the working of different high pressure boilers, mountings and accessories & steam power plant and methods of improving efficiency of plant
2. To enable the students to understand working of various nozzles and calculate the exit velocity and areas of nozzle and the working principles of steam condensers and their analysis.
3. To enable the students to understand the basic principles of steam turbines and analysis of both impulse and reaction turbines.
4. To enable the student to understand the basic principles of refrigeration and air conditioning systems and to understand the various Psychrometric processes and summer and winter air conditioning systems.

COURSE OUTCOMES:

After completion of the course, the students are able to

1. Determine the performance of a steam power plant with the knowledge of the properties of steam and high-pressure boilers with their mountings and accessories.
2. Calculate the maximum discharge, areas at various locations of steam nozzles, and vacuum & condenser efficiencies of steam condensers.
3. Determine the blade angles, various velocities, and efficiencies by using a velocity diagram and analytical methods for both impulse and reaction turbines.
4. Describe the operation of air refrigeration, vapour compression refrigeration systems, and air conditioning systems for summer and winter seasons.

COURSE CONTENT:

UNIT-1	CO1	12
Pure Substance: Definition, process of steam generation, P-v, T-s and h-s diagrams, properties of Wet, Dry Saturated and Superheated steam, Use of Steam Tables, Mollier chart. **Steam Boilers**: Function, classification, working of Benson &La Mont boilers, Mountings & Accessories. **Vapor Power Cycles:** Rankine cycle, Effect of pressure and temperature on the Rankine cycle performance, reheat cycle, regenerative cycle.		
UNIT-2	**CO2**	**12**
Steam Nozzles: Types of nozzles, isentropic flow through nozzles, Effect of friction, Nozzle efficiency, Critical pressure ratio and maximum discharge, calculation of throat and exit areas using Mollier diagram. **Steam Condensers:** Jet and Surface condensers, importance of condenser vacuum, Vacuum efficiency, Condenser efficiency, Thermodynamic analysis, Air pumps, Capacity of air extraction pump.		
UNIT-3	**CO3**	**12**
Steam Turbines: Types of steam turbines, Impulse turbines, pressure and velocity compounding, Velocity diagrams, work output, power, blade efficiency and stage efficiency, Reaction turbines, velocity diagrams, degree of reaction, work output, power, blade efficiency and stage efficiency, Governing of turbines, Overall efficiency and reheat factor.		

UNIT-4	CO4	12
Refrigeration: Need for Refrigeration, Definitions, Methods of refrigeration, Working of Refrigerator and Heat pump, Bell-Coleman cycle, Refrigerating effect, COP, Vapour compression refrigeration system, Influence of various parameters on cycle performance, Vapour Absorption cycle. **Psychrometry and Air conditioning:** Introduction, Psychrometric properties, Psychrometric chart, Psychrometric processes, Summer and Winter air conditioning systems		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Thermodynamics An Engineering Approach Y. A. Cengel& M. A. Boles, TMH, 6th Edition, New Delhi,2010.
2. Thermal Engineering- M.M. Rathore, TMH, NewDelhi,2010
3. Thermal Engineering ---Rajput, LaxmiPubl, New Delhi , 2012

REFERENCE BOOK(S):

1. Treatise on Heat Engineering-V.P.Vasandani and D.S.Kumar, Metropolitan Book co, New Delhi, 4thEdition
2. Refrigeration and Air Conditioning- R. S. Khurmi and Gupta

WEB REFERENCE:

1. IIT Video Lectures (NPTEL)
2. http://www.iscid.org/encyclopedia/Tthermodynamics
3. http://www.transtutors.com/

ME 223	STRENGTH OF MATERIALS	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. To provide the concept of stresses and strains including thermal stresses, elastic constants and relations among them.
2. To discuss basic principles of torsion in shafts and shear force & bending moment in beams.
3. To make the students understand the theory of simple bending, stresses and deflections of beams.
4. To establish an understanding of the two-dimensional stresses, strains and analysis of thin and thick pressure vessels.

COURSE OUTCOMES:

At the end of completion of the course, the student will be able to:

1. Calculate the stresses and strains in axially loaded members.
2. Analyze the shafts subjected to torsion.
3. Draw shear force & bending moment diagrams for the beams.
4. Determine bending, shear stresses, slope, and deflections in beams.
5. Compute principal stresses and strains, for plane stress and plane strain conditions.
6. Determine the stresses in thin and thick pressure vessels.

COURSE CONTENT:

UNIT-1	CO1	12
Simple Stresses & Strains: Introduction, Normal Stress and Strain, Stress- Strain Diagrams, Elasticity, Plasticity and creep, Linear Elasticity, Hooke's Law and Poisson's ratio, Shear Stress and Strain, Bulk Modulus, shear modulus, Young's modulus, Relation between elastic constants, factor of safety and allowable stresses, Bars of uniform and varying cross sections, composite bars, temperature stresses and Strain energy.		
UNIT-2	**CO2, 3**	**12**
Torsion: General equation of torsion for circular members, torsion in solid circular, hollow circular and stepped bars. Torsion in bars fixed at both the ends **Shear Force and Bending Moment:** Types of Beams, Shear Force and Bending Moment, Relationships between Load, Shear Force and Bending Moment, Shear Force and Bending Moment Diagrams for cantilever, Simply supported, Over hanging beams subjected to Point loads, Uniformly distributed loads, Uniformly varying loads and combination of these loads, Point of contra flexure.		
UNIT-3	**CO4**	**12**
Stresses in beams: Theory of simple bending, bending equation, determination of flexural stresses for simple cases, Shear stress formula, Shear stress distribution in beams having I- Section, T-Section, rectangular and Circular sections. **Beam deflections:** Basic differential equation of deflection curve, determination of slopes and deflections of cantilever, simply supported and overhanging beams by double integration method		

and Macaulay's method.		
UNIT-4	**CO5,6**	**12**
Two-dimensional state of Stress and Strain: Plane Stress, Principal Stresses and Maximum Shear Stress, Mohr's Circle for Plane Stress, Plane Strain, Principal Strains and Maximum Shear Strain, Mohr's Circle for Plane Strain. **Pressure Vessels:** Thin Spherical and Cylindrical Pressure Vessels, Thick Cylinders: Lame's theory, thick cylinders under internal fluid pressure.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Mechanics of Materials by James M. Gere and Barry J. Goodner, Published by Cengage Learning, 8thedition.
2. Strength of materials by Sadhu Singh, Khanna Publishers, 11thEdition

REFERENCE BOOK(S):

1. Engineering Mechanics of Solids by E.P .Popov, PHI, 2nd Edition.
2. Strength of Materials by S. Ramamrutham, Dhanpat Rai Publishing Company (P) Ltd, 18th Edition
3. Introduction to Solid Mechanics by I.H. Shames, PHI, 3rdEdition.
4. Strength of Materials by R.K. Bansal, Laxmi Publications, 6thEdition.

WEB REFERENCE:

1. http://nptel.iitm.ac.in/
2. www.learnerstv.com/Free-Engineering-video-lecture-courses.html

ME 224	MANUFACTURING TECHNOLOGY	L	T	P	C	Int	Ext
		3	0	-	3	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. To provide the fundamental knowledge regarding the working principle, specifications, parts and various operations performed lathe and drilling machine tools.
2. To provide the fundamental knowledge regarding the working principle, specifications, parts and various operations performed milling and grinding machine tools.
3. To provide basic information regarding the way of formation of chips, deformation of work piece, generation of temperature, cutting forces. cutting tool materials
4. To develop knowledge in design considerations, principles and related devices used in Jigs and Fixtures
5. Understand Unconventional manufacturing methods employed for making different products.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Identify the principle of Lathe and Drilling machines and their mechanisms
2. Describe the principles of Grinding and surface finishing machines
3. Demonstrate the nomenclature of tool and the parameters in the selection of tools and learn the various forces acting on tooling.
4. Identify the principles of Unconventional manufacturing methods employed for making different products.
5. Define functions of location, clamping devices and their applications in JIGS& FIXTURES

COURSE CONTENT:

UNIT-1	**CO1**	**12**
Lathe: Constructional details, specifications, classification of lathes. Lathe accessories - various work holding devices, Lathe operations including taper turning and thread cutting. Drilling Machines: Types and specifications, spindle feed mechanism, drilling operations.		
UNIT-2	**CO2**	**12**
Grinding Machines: Working principle of cylindrical, center less and surface grinding machines. Grinding Operations, Glazing, loading, Truing and dressing. Surface Finishing Operations: Honing and lapping operations.		
UNIT-3	**CO3**	**12**
Theory of Metal Cutting: Introduction, Nomenclature of single point cutting tool, Tool Geometry, Mechanics of chip formation, types of chips. Determination of shear angle and chip thickness ratio, stress and strain in the chip, velocity relations, Merchant's theory of orthogonal cutting forces, related simple problems. Tool wear, tool life and tool life criteria related simple problems, cutting fluids-types and required characteristics. Requirements of tool materials and types		
UNIT-4	**CO4,5**	**12**
Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters. Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, wire cut EDM; Electro-chemical machining (ECM). Plasma Arc Machining (PAM). **Jigs & Fixtures:** Introduction, design considerations in jigs& fixtures. The principle of six point location, locating pins, Clamping and clamping devices.		

LEARNING RESOURCES:

TEXT BOOK(s):

1. Elements of Workshop Technology Vol. II by HazraChowdary , Media Promoters & Publishers, 1983
2. Production Engineering by P.C. Sharma, S.Chand&Co , 2007.

REFERENCE BOOK(s):

1. Manufacturing Engineering & Technology by Kalpak Jain, PHI , 5th Edition ,2005.
2. Materials and Processes in Manufacturing by E.Paul De Garmo, J.T.Black and Ronald A.Kohser , John Wiley & Sons,2003.
3. ManufacturingSciencebyA.Ghosh&A.K.Mallik,AffiliatedEast-WestPress(P)Ltd.,NewDelhi ,RePrint 1998

WEB RESOURCES:

1. www.mini-lathe.com/links.htm,machinedesign.com/.../designer-sguidetometalcutting-machinery-0608
2. www.metalwebnews.com/wc.html
3. www.americanmachinist.com
4. www6.conestogac.on.ca/~ffulkerson/J&F%20Notes.pdf

ME 225	FLUID MECHANICS & HYDRAULIC MACHINES	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. To learn about the application of mass and momentum conservation laws for fluid flows.
2. To understand the importance of dimension analysis.
3. To obtain the knowledge to draw velocity triangles in various types of roto-dynamic machines and analyze the flow in water turbines.
4. To analyze the flow in water pumps.

COURSE OUTCOMES:

After completion of the course, students are able to

1. Identify the importance of various fluid properties at rest and in motion.
2. Apply general governing equations for fluid friction during pipe flow.
3. Analyze the dimensional and model analysis, and their applications.
4. Illustrate the distinctive features of various hydraulic turbines, such as Pelton, Francis and Kaplan turbines, and their performance characteristics
5. Illustrate the features of various hydraulic pumps, such as Centrifugal and reciprocating Pumps, and their performance characteristics.

COURSE CONTENT:

UNIT-1	**CO1**	**12**
Definition of fluid, Newton law of viscosity, Units and dimensions-Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension-Simple numerical problems. Control volume-application of continuity equation, Incompressible flow, Euler's equation, Bernoulli's equation and simple numerical problems. Applications on Bernoulli principle (working principle and derivations on Pitot tube, venturimeter and orifice meter only, numerical problems not included).		
UNIT-2	**CO2,3**	**12**
Fluid flow Types, Reynolds experiment, laws of fluid friction, Darcy-Wiesbach equation, Laminar flow through a circular conduits, Hagen-Poiseulle law, concept of boundary layer, measures of boundary layer thickness. Need for dimensional analysis, methods of dimension analysis, Buckingham Pi theorem-simpler problems, Similitude, types of similitude, dimensionless parameters, application of dimensionless parameters, model analysis.		
UNIT-3	**CO4**	**12**
Basics of turbo machinery: Impact of jets on stationary and moving flat plates, inclined and curved vanes, Jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial curved vanes. Hydraulic turbines: Classification of water turbines, working principle of Pelton wheel, Francis turbine and Kaplan turbines, work done and efficiencies, performance characteristic curves, draft tube theory.		
UNIT-4	**CO5**	**12**

Reciprocating Pumps: Types, Working principle, Power required by a Reciprocating pump, Coefficient of discharge, Slip and negative slip, Effect of Acceleration of piston on velocity and pressure in suction and delivery pipes, Indicator diagram and Air vessels.
Centrifugal Pumps: Types, Working principle, Reciprocating vs. Centrifugal pump, Work done by impeller, Head of a pump, losses and efficiencies, Minimum starting speed, Specific speed, Multistage pumps, Pumps in parallel, Performance characteristic curves, limitation of suction lift, NPSH.

LEARNING RESOURCES:

TEXT BOOK(S):

1. Hydraulics and Fluid Mechanics --P.N. Modi& S.M. Seth, Standard Book House, New Delhi, Fourteenth edition,2002
2. Fluid Mechanics & Hydraulic Machines - R.K.Bansal, Laxmi Publications, revised Ninth edition, reprint2015.
3. Fluid mechanics and Hydraulic Machines –R.K.Rajput, S. Chand and Company Limited, Sixthedition2015.

REFERENCE BOOK(S):

1. Fluid Mechanics & Fluid Power Engineering - D.S. Kumar, SK Kataria & sons, New Delhi, RePrintedition2012.
2. Introduction to Fluid Mechanics &Fluid Machines - S K Som, Gautam Biswas, Suman Chakraborty, Tata McGraHill Publications, 3rd edition2017.
3. Fluid Mechanics & Hydraulic Machines - K. Subramanya, McGra Hill Publications, Second edition2018.

WEB REFERENCE:

1. www.hydraulicspneumatics.com
2. http://www.efluids.com/
3. http://fluid.power.net/
4. www.pumps.org/

ME 261	MANUFACTURING PROCESS LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. To provide an understanding of advanced manufacturing methods
2. To get an idea of the dimensional & form accuracy of products
3. To cultivate the ability to develop and implement new improved manufacturing processes resulting in creation and distribution of value in engineering applications
4. To impart knowledge about the significance of controlling process parameters for the optimal performance for newly developed engineering materials used in industries.

COURSE OUTCOMES:

After the successful completion of the course, students are able to

1. Illustrate various operations like Taper turning, external thread cutting on Lathe
2. Experiment on milling machine for cutting Contour milling, Spur gear cutting etc.
3. Demonstrate Tool and Cutter Grinder for making of single point cutting tool
4. Use shaping and slotting machines for cutting keyways and slots

EXPERIMENTS:

1. Taper turning and external thread cutting using lathe
2. Internal Taper turning and internal thread cutting using lathe
3. Contour milling using vertical milling machine
4. Spur gear cutting in milling machine
5. Measurement of cutting forces in Milling/ Turning process
6. Drilling of a small hole using wire EDM
7. Grinding single point cutting tool on Tool and Cutter Grinder
8. Machining Key way on Shaping Machine
9. Machining a spline on Slotting Machine

Note:**

A minimum of 8 experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

ME 262	FM & SM LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. Apply fundamental principles of fluid mechanics for the solution of practical Mechanical engineering problems of water conveyance in pipes, pipe networks, and open channels.
2. Describe the operating characteristics of hydraulic machinery (pumps and turbines), and the factors affecting their operation and specifications, as well as their operation in a system.
3. Understanding the basic strength of materials principles by conducting experiments
4. Learn to analyze and synthesize test results, write individual and group reports incorporating experimental data, graphs, assessment of results, and conclusions 3. To give more understand in basic of structural field

COURSE OUTCOMES:

After Completion of the course, the students are able to

1. Determine the discharge of fluid flow through Venturi meter and Orifice
2. Demonstrate the performance of Pelton wheel turbine and Centrifugal pump.
3. Analyse the behaviour of materials and structural elements, including distribution of stresses and strains, deformations and failure modes.

EXPERIMENTS:

1. Orifice - Determination of coefficient of discharge
2. Venturi meter - Determination of coefficient of discharge
3. Pipe friction - Determination of friction factor and size of roughness of a given pipe
4. Single - stage centrifugal pump - To draw the operating characteristics of the pump and to determine the designed discharge and designed head from it.
5. Single - acting reciprocating pump - To draw the operating characteristic curves at constant speed and determination of efficiency.
6. Gear pump - To draw the operating characteristic curves and determination of overall efficiency of a pump
7. Pelton turbine - To draw the performance characteristic curves and determination of overall efficiency
8. Francis turbine - To draw the performance characteristic curves and determination of overall efficiency.
9. Kaplan turbine - To draw the performance characteristic curves and determination of overall efficiency
10. (a)Rockwell Hardness test- Determination of Hardness Number for different metal specimens such as mild steel, cast iron, Brass, Aluminum.
    (b) Brinnell's Hardness Test - Determination of Hardness Number for different metal specimens such as mild steel, cast iron, Brass, Aluminum
11. Impact Test - (a) Charpy and (b) lzod: Determination of impact strength of mild steel and cast iron specimens
12. Tension Test on UTM - Determination of mechanical properties of mild steel and cast iron specimens
13. Tests on helical spring - Determination of stiffness of helical springs
14. To find the modulus of rigidity by conducting torsion test on solid circular shaft

ME 263	COMMUNICATIVE ENGLISH LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. To build confidence and enable students speak better English.
2. To motivate students to use English in different situations and contexts.
3. To enable students understand the importance of preparation and practice in presentations.
4. To enable them to understand the basic nuances for effective language communication.
5. Practice comprehensible pronunciation of English.

COURSE OUTCOMES:

Upon completion of the course students shall.

1. Recognize the need of good communication skills for professional courses.
2. Explain the basic tenets of communication.
3. Articulating syllables clearly, speaking fluently with correct pronunciation.
4. Develop their self awareness.
5. Discuss the importance of group dynamics.

UNIT I [CO:1]**(7)**

Basics of Presentations

Ice breaking session

Student Presentation-I

Learning about Presentations

Presentation structure

Managing nerves in a presentation

Mini Presentations

Feedback on presentations

UNIT II [CO:2,3]**(7)**

Professional and Personal Grooming

Functional English

Non Verbal Communication

Stage Manners

Understanding and preparing a Presenta

Team presentations

UNIT III [CO:4]**(7)**

Speech Nuances

- Pronunciation
- MTI-Mother Tongue Influence
- Stress in English

- Tempo of Speech
- Indianisms and Often Made Mistakes Idioms & Phrasal verbs

UNITIV [CO:5]**(7)**

Free Talk

Dilemma Questions
Paraphrasing an article or a video in student's own words (Team task)
Impromptu speeches
Introducing TED TALKS
Movie based Learning-Karate Kid Movie-Understanding Life Skills

LEARNING RESOURCES:

REFERENCE BOOK(s):

1. Making Successful Presentations :A Self-Teaching Guide-Terry C.Smith,19846
2. Professional Presentations –Malcom Goodale
3. Giving Presentations –Jo Billingham
4. APA ART Speak Well I
5. HANDOUTS

MESL2	NUMERICAL TECHNIQUES & SIMULATION	L	T	P	C	Int	Ext
	SKILL ORIENTED COURSE	1	0	2	2	100	--
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. Help Students to feel justifiably confident of their ability to write small programs.
2. Solve real world problems using MATLAB
3. Understand the principles of Programming and MATLAB environment.
4. To understand MATLAB graphic feature and its applications.

COURSE OUTCOMES:

After Completion of the course, the students are able to

1. Recognize MATLAB Built in functions to carry out matrix operations and use of arrays.
2. Manipulate their own calculations and comparisons
3. Demonstrate the Functions used along with plotting, creating figures etc.
4. Implement numerical solution of ordinary differential equations using MATLAB code

COURSE CONTENT:

UNIT-1	**CO1**	**6**
DefiningVariables–functions–MatricesandVectors–Strings–InputandOutputstatements-Script files – Arrays in Mat lab – Addressing Arrays – Dynamic Array – Cell Array – Structure Array – File input and output – Opening & Closing – Writing & Reading data from files.		
UNIT-2	**CO2**	**6**
Relational and logical operators – Control statements IF-END, IF-ELSE – END, ELSEIF, SWITCH CASE – FOR loop – While loop – Debugging – miscellaneous MAT lab functions & Variables.		
UNIT-3	**CO3**	**6**
Basic2Dplots–modifyinglinestyles–markersandcolours–grids–placingtextonaplot–Various /SpecialMatLab2Dplottypes–Examples.Linearalgebraicequations–elementarysolutionmethod – matrix method for linear equation – random number generation – Interpolation – Analytical solution to differential equations – Numerical methods for differential equations- Programs.		
UNIT-4	**CO4**	**12**
MATLAB Programming for Engineering Applications. Simulink – Introduction -Simulink model for a Spring Mass system.		

LEARNING RESOURCES:

REFERENCE BOOK(S):

1. "A Guide to MATLAB - for Beginners and Experienced Users", 2nd Ed., Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, Cambridge University Press,(2006).
2. "Essentials of MATLAB Programming", 2nd Ed., Stephen J. Chapman, Cengage Learning, (2009).
3. "MATLAB Demystified", David McMahon, The McGraw-Hill Companies,(2007).
4. "MATLAB® for Engineers", 3rd Ed., Holly Moore, Pearson Education, Inc.,(2012).
5. "Engineering computation with MATLAB", 2nd Ed., David M. Smith, Pearson Education, Inc., (2010).

WEB REFERENCE:

https://www.mathworks.com/products/matlab.html

MEMC4	DESIGN THINKING AND PRODUCT INNOVATION	L	T	P	C	Int	Ext
	MANDATORY COURSE	2	0	0	0	100	--
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. Identify the design thinking processes and methods.
2. Plan research activities to gather and empathize from a user's view point.
3. Ideate techniques to help arrive at the best solution and evaluation.
4. Identify design thinking approaches for business challenges.

COURSE OUTCOMES:

1. Demonstrate an understanding of how Design Thinking can be applied across diverse fields and industries.
2. Comprehend the techniques such as observations, interviews, and user journey mapping used to empathize with users.
3. Identify the significance of experimentation, engagement, and evolution in the design process.
4. Interpret the alignment between Design Thinking principles and strategic goals in organizations

COURSE CONTENT:

UNIT-1	CO1	12
Introduction to Design Thinking – Origin of Design Thinking, Features & Principles of Design Thinking, Applications of Design Thinking, Role of Research in Design Thinking.		
UNIT-2	**CO2**	**12**
Modules of Design Thinking – Inspiration – methods & tools used in Explore and Empathize phases of Design Thinking, Case study-activity.		
UNIT-3	**CO3**	**12**
Modules of Design Thinking – Ideation & Implementation – methods & tools used in Experiment, Engage and Evolve phases of Design Thinking, Case study-activity.		
UNIT-4	**CO4**	**12**
Design Thinking applied in Business & Strategic Innovation – Ten Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extremecompetition,Standardization,CreativeCulture,Strategy&Organization–DesignThinking approaches.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. "Design Thinking for Entrepreneurs and Small Businesses" by Beverly Rudkin Ingle, Apress. [UNIT-1]
2. "Change by design", Tim Brown, Harper Collins, 2009 [UNIT-1]
3. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil service Commission, Bhutan. [UNIT –II &III]
4. IdrisMootee,"DesignThinkingforStrategicInnovation",JohnWiley&Sons(2013).[UNIT-IV]

REFERENCE BOOK(S):

1. "Design Thinking Business Innovation", Rio de Janeiro – 2012 1st edition, MJVpress.

2. "Design Thinking- Understanding How Designers Think and Work" by Nigel Cross, Berg publishers.

WEB REFERENCE:

- IDEO: Design Thinking for Educators toolkithttps://designthinkingforeducators.com/.
- https://dschool.stanford.edu/resources/a-virtual-crash-course-in-design-thinking
- https://dschool-old.stanford.edu/groups/designresources/wiki/4dbb2/(walletProject)

III YEAR

ME 311	DESIGN OF MACHINE ELEMENTS	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER V [THIRD YEAR]						

COURSE OBJECTIVES:

1. To understand procedure of machine design, different theories of failure and develop an ability to apply its knowledge for design of mechanical component.
2. To make the students to understand the forces on power screw and bolted joints and formulate design solution for size of power screw and size of bolt.
3. To assist the students in the design of riveted and welded joints and springs under different loading conditions.
4. To inculcate the knowledge in the selection and design of bearings and flywheel subjected to different loading conditions.

COURSE OUTCOMES:

At the end of completion of the course, the student will be able to:

1. Design mechanical elements under static and dynamic loading conditions.
2. Design screw jack and threaded fasteners for the given operating conditions.
3. Design springs, riveted joints and welded joints under different loading conditions.
4. Design bearings and flywheel for the given application.

COURSE CONTENT:

UNIT-1	CO1	12
Basics: Introduction, basic procedure of machine design. **Design for Static Strength:** Simple Stresses, Combined stresses, torsion and bending stresses, various theories of failure, Factor of safety and its importance in design, stress concentration factors, reduction of stress concentration. **Design for Fatigue Strength:** Fluctuating stresses, fatigue failure, endurance limit, low cycle and high cycle fatigue, notch sensitivity, endurance approximate estimation, reversed stresses design for infinite life, cumulative damage in fatigue, Soderberg and Goodman lines, modified Goodman diagrams, Gerber equation, fatigue design under combined stresses.		
UNIT-2	**CO2**	**12**
Power Screws: Types- Mechanics of power screws, efficiency, Design of Screw Jack. **Threaded Joints:** Basic types, bolt of uniform strength, materials and manufacture, eccentrically loaded bolted joints in shear, eccentric load perpendicular to axis of bolt, eccentric load on circular base.		
UNIT-3	**CO3**	**12**
Riveted and Welded Joints: Boiler Joints & Lozenge Joint, Design of joints under eccentric loading and eccentrically loaded welded joints. **Springs:** Introduction, Materials, Types of springs, Design of helical springs under axial load and fatigue loading.		
UNIT-4	**CO4**	**12**
Bearings: Types of Bearings, bearing materials, Journal bearing design (using McKee"s equation and Raymond and Boyd charts & tables) Ball and Roller Bearings: Static load, Dynamic load, Equivalent radial load, selection of ball and roller bearings. **Flywheel**: Introduction, construction, Torque analysis, solid flywheel, Rimmed flywheel, stresses in rimmed flywheel, Design of flywheel.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Design of Machine Elements by V.B. Bhandari, Tata McGraw Hill, 3rd Edition,2017.
2. ***Machine Design by P.C. Sharma & D.K. Agarwal., S.K. Kataria& Sons ,2003.***
3. Design of Machine Elements by C.S. Sharma & K. Purohit ,PHILtd,2005.
4. Machine Design by R.S. Khurmi& J.K. Guptha , S. Chand ,2012.

REFERENCE BOOK(S):

1. Shigley, J.E. and Mischke, C.R., Mechanical Engineering Design, Fifth Edition, McGraw-Hill International; 1989.
2. Deutschman, D., Michels, W.J. and Wilson, C.E., Machine Design Theory and Practice, Macmillan,1992
3. Juvinal, R.C., Fundamentals of Machine Component Design, John Wiley,1994.
4. Spottes, M.F., Design of Machine elements, Prentice-Hall India,1994.
5. R. L. Norton, Mechanical Design – An Integrated Approach, Prentice Hall,1998

DESIGNDATA BOOK(S):

1. Design data book, P.S.G. College of Tech,Coimbatore
2. Design data book, Mahadevan &Balaveera Reddy - CBSPub

WEB REFERENCE:

1.https://nptel.ac.in/courses/112/105/112105124/

2. http://www.nptelvideos.in/2012/12/design-of-machine-elements.html
3. https://engineeringvideolectures.com/course/791

ME 312	METROLOGY & MEASUREMENTS	L	T	P	C	Int	Ext
		3	0	-	3	30	70
	SEMESTER V [THIRD YEAR]						

COURSE OBJECTIVES:

1. Students will be able to understand and know the system of tolerances, fit between mating parts, types of fits. Students will be able to understand the concepts of assembling of components.
2. Students will learn about terminology related to surface structure based on Indian standard organization and will understand the alignment of machines like bed and chucks etc., on different machine tools and their performance.
3. Students will be able to design and use sensors and Transducers to inspect the components
4. Students will be able to identify the required control systems for various equipment's.

COURSE OUTCOMES:

At the end of completion of the course, the student will be able to:

1. Select methods and devices for the measurement of geometric features of components
2. Use limit gauges to check the component tolerances of manufactured parts.
3. Describe comparators and surface finish instruments
4. Describe the basic concepts in sensors, transducers, strain and pressure measurement devices.
5. Demonstrate the temperature, torque and force measurement devices

COURSE CONTENT:

UNIT-1	**CO1,2**	**12**
Metrology: Introduction, standards of length, end and line standards, Interchangeability, selective assembly. Linear and Angular Measurements: Precision measurement, bore gauges, straight edges, slip gauges, angle gauges, sine bars, spirit levels. **Systems of Limits and Fits:** Limits, fits, tolerance and allowance, theory of limits and fits and their selection, hole basis and shaft basis system, Indian standard system of limits and fits, simple problems. **Limit Gauges:** Taylor's principle of limit gauging, plug gauges, ring gauges. Tolerance Limits of a process.		
UNIT-2	**CO3**	**12**
Comparators: Mechanical comparators-Sigma comparator, electrical and electronic comparators, solex pneumatic gauge, tool maker‟s microscope. **Measurement of Surface Finish:** Surface texture, roughness, waviness, Indian standard terminology, Methods of measuring surface finish, Taylor Hobson Talysurf. **Interferometry**: NPL flatness interferometry and gauge length interferometer, auto collimator.		
UNIT-3	**CO4**	**12**
Basic Concepts: Introduction, Measurement system elements, Static Performance characteristics:		
Calibration, standards, Accuracy, Precision, Sensitivity, Resolution, range and Span. sources of Errors. **Sensors and Transducers:** Introduction, Transducer classification, LVDT, Piezo electric, photo electric and Ionization transducers. **Strain Measurement**: Introduction, electrical resistance strain gauges principle, Gauge factor, Temperature compensation in strain gauge. Rosette. **Pressure Measurement:** Introduction, pressure measurement terms, Bourdon tube pressure gauge, Diaphragm and Bellows, Low pressure measurement: McLeod gauge		

UNIT-4	CO4	12
Temperature Measurement: Introduction, Bi-metallic thermometers, Thermo-Resistive elements, Thermocouples, Thermisters and Pyrometers. **Force Measurement:** Introduction, Elastic force meters, Load cells- Strain Gauge load Cell, Hydraulic and pneumatic load cell. **Torque Measurement:** Optical torsion meter, strain gauge torsion meter. **Control System:** Introduction to control Systems, Definitions of control system terminology, classification of control systems, examples of control systems.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Engineering Metrology - R. K. Jain, Khanna Publishers, 20th Edition,2012.
2. Mechanical Measurements & Control - by D.S. Kumar, Metropoliton Book Company.
3. Mechanical Measurements by R.S.Sirohi & H.C. Radhakrishna, New Age International.
4. Instrumentation and control system by W.Bolton, 2nd edition, Newnes.
5. Hand Book of Industrial Metrology by ASTME, Prentice-Hall(1967)

REFERENCE BOOK(S):

1. Engineering Metrology - D. M.Antony.
2. A Text book of Engineering Metrology-I C Gupta, Dhanapati Rai Publications, 7^{th}Edition.
3. Mechanical Measurements - T.B.Beckwith & N.L.Buck ,Addison-Wesley,1969.
4. Control System Engineering – Nagarath & Gopal, New Age International,2010.

WEB REFERENCE:

1. http://emtoolbox.nist.gov
2. www.CambridgeViscosity.com/Viscometer
3. www.e.FlukeCal.com/Calibration
4. www.inscotemperature.com

ME 313	MACHINE DYNAMICS AND VIBRATIONS	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER V [THIRD YEAR]						

COURSE OBJECTIVES:

1. To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms and the analysis of governors is introduced
2. To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism and to learn about principles in mechanisms used for stability control.
3. To understand the purpose of Brakes, dynamometers and clutches and solve related engineering problems
4. To understand the effect of Dynamics of undesirable vibrations.

COURSE OUTCOMES:

At the end of completion of the course, the student will be able to:

1. Analyse dynamic forces in slider-crank mechanism.
2. Describe the working and functioning of various types of governors
3. Determine the magnitude and position of balancing masses for unbalanced rotating and reciprocating parts.
4. Analyze the effect of gyroscopic couple on two-wheel vehicles and naval ships.
5. Explain the working of brakes, dynamometers and clutches.
6. Formulate free and forced vibrations of a single degree freedom systems.

COURSE CONTENT:

UNIT-1	CO1,2	12
Dynamic Force Analysis: Introduction, Dynamic Analysis of Slider - Crank mechanism (Using Analytical method) Velocity and Acceleration of piston, Angular velocity and Angular Acceleration of Connecting Rod, Piston Effort (Effective Driving Force), Crank Effort. Turning Moment on Crankshaft, Inertia of connecting Rod. **Governors:** Introduction, Types of Governors, Watt Governor, Porter Governor, Hartnell Governor, Sensitiveness of a Governor, Hunting, Isochronism, Stability, Controlling force, Power of a Governor.		
UNIT-2	**CO3,4**	**12**
Balancing: Introduction, Static balancing, Dynamic balancing, transferring of a Force from one plane to another, Balancing of Several Masses in Different planes, Primary & Secondary Balancing of Reciprocating Mass, Balancing of in line Engines and V Engines. **Gyroscopes:** Angular Velocity, Angular Acceleration, Gyroscopic Torque, Gyroscopic Effect on Naval Ships, Stability of a two-wheel vehicle.		
UNIT-3	**CO5**	**12**
Brakes and Dynamometers: Introduction, types of brakes- Block or shoe brakes, band brakes, Band & block brakes**.** Dynamometers – Types of Dynamometers- General description and methods of operation of Poney, Rope, Epicyclical, Bevis-Gibson and belt transmission dynamometers. **Clutches:** Introduction**,** Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch and centrifugal clutch.		

UNIT-4	CO6	12
Un-damped and Damped Free Vibrations of Single Degree of Freedom Systems: Fundamentals of Vibration-Introduction, Definitions, Vector method of representing Harmonic Motions, Addition of two simple Harmonic motion of the same frequency, degrees of freedom, Derivations of differential equations, Equivalent stiffness of spring combinations, Energy Method. Different types of damping, Free vibrations with viscous damping, Logarithmic Decrement, Viscous dampers, Coulomb damping, solid or structural damping and slip interfacial damping. **Un-damped and Damped Forced Vibrations of Single Degree of Freedom Systems:** Introduction, forced vibrations with constant Harmonic excitation, forced vibration with rotating and reciprocating unbalance. Critical speed of a light shaft having a single disc without damping and with damping, Vibration, isolation and transmissibility, vibration measuring instruments.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Theory of Machines by S.S. Rattan , TMH , 3rd Edition , 2009.
2. Mechanical Vibrations - G.K.Groover , Nem Chand Bros , 7th Edition , 2003.
3. Mechanical Vibrations - Rao V.Dukkipati, J.Srinivas, PHI , 2004.

REFERENCE BOOK(S):

1. Theory of Machines by T. Bevan , Cbs Publishers ,2004.
2. Theory of Mechanisms and Machines by A. Ghosh and A.K. Mallik, Affiliated East-West Press (P)Ltd., New Delhi , 3rd Edition ,Re Print2000
3. Mechanical Vibration - S.S.Rao , Addison & Wesley ,1995.
4. Theory of Machines by RS khurmi and J.k. Gupta

DESIGNDATA BOOK(S):

1. Design data book, P.S.G. College of Tech,Coimbatore
2. Design data book, Mahadevan &Balaveera Reddy - CBSPub

WEB REFERENCE:

1. Machine Dynamics by Prof. Amitabha Ghosh, IITK, Kanpur ,http://nptel.iitm.ac.in/video.php?subjectId=112104114
2. Machine Dynamics by Prof.C.Amarnath, Prof.K.Kurien Issac, Prof.P.Seshu of IITB, Mumbai http://www.cdeep.iitb.ac.in/nptel/Mechanical/Dynamics%20of%20Machines/TOC.html

ME 314	PROFESSIONAL ELECTIVE-I	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER V [THIRD YEAR]						

Professional Elective Courses

Design	Thermal	Production	Industrial
MEEL1 Computer Aided Design	MEEL6 I C Engines and Gas Turbines	MEEL12 Automation in Manufacturing	MEEL17 Product Lifecycle Management
MEEL2 Finite element Methods	MEEL7 Refrigeration and Air Conditioning	MEEL13 Introduction Composite Materials	MEEL18 Industrial Management
MEEL3 Mechatronic System Design MEEL4 Fluidics and control systems	MEEL8 Automobile Engineering MEEL9 Elements of Aerospace Engineering	MEEL14 Advanced Metal Casting	MEEL19 Process Planning and Cost Estimation
MEEL5 Industrial Robotics	MEEL10 Power Plant Engineering MEEL11 Energy Conservation & Management	MEEL15 Safety in Engineering Industry MEEL16 Maintenance Engineering	MEEL20 Total Quality Management

Note: Syllabus given in professional electives section of book.

ME 315	OPEN / JOB ORIENTED ELECTIVE-I	L	T	P	C	Int	Ext
		2	-	2	3	30	70
	SEMESTER V [THIRD YEAR]						

Open Elective Courses (Offered by other Departments)

Code No.	Subject Name	Code No.	Subject Name
CEOL1	Basic Surveying	CEOL2	Building Materials and Construction
CHOL1	Energy Engineering	CHOL2	Solid Waste Management
CSOL1	Programming with Java	CSOL2	Relational Database Management Systems
CBOL1	Operating Systems Concepts	CBOL2	Business Analytics
CMOL1	Fundamentals of Artificial Intelligence	CMOL2	Programming with C++
CDOL1	Python for Data Science	CDOL2	Data Science for Engineers
COOL1	Architecting Smart IoT Devices	COOL2	Fog Computing
ECOL1	Applied Electronics	ECOL2	Microprocessors & Interfacing
ECOL3	Linear ICs and Applications	EEOL1	Renewable Energy Sources
EEOL2	Utilization of Electrical Energy	ITOL1	Data Structures & Algorithms
ITOL2	Web Technologies		

Job Oriented Elective Courses

Course Code	Course Name	Course Code	Course Name
JOEL01	Big Data Processing	JOEL12	Building Planning
JOEL02	Full Stack Development	JOEL13	Quantity Estimation
JOEL03	JavaScript Technologies	JOEL14	Bio Fuels
JOEL04	Cloud Computing using AWS	JOEL15	Environmental Engineering
JOEL05	DevOps	JOEL16	Safety Management
JOEL06	Enterprise Programming	JOEL17	Non-Conventional Energy Engineering
JOEL07	Predictive Modeling and Analysis	JOEL18	Biopharmaceutics and Drug Design
JOEL08	Data warehousing and mining	JOEL19	Embedded Systems-1
JOEL09	Interface and Programming With IoT Gateway	JOEL20	Embedded Systems-2
JOEL10	IoT Cloud and Data Analytics	JOEL21	Open Source Systems
JOEL11	Geospatial Technology	JOEL22	Machine Learning

Note: Syllabus given in open electives section of book.

ME 351	CAM LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER V [THIRD YEAR]						

COURSE OBJECTIVES:

1. Learn the programming of computer numerical control (CNC) machines with CAD/CAM systems.
2. Learn CNC Manual part programming for different contours using Lathe module of the CNC Lathe software.
3. Learn CNC Manual part programming for different contours using Mill module of the CNC Mill software.
4. Demonstrate and make the students to create the model using Master cam software to convert the modeled part geometry into a cutter tool path for use on a numerically controlled lathe and milling machines
5. Gain experience and safely operate the CNC lathe and milling machines, and programming and machining complex engineering parts.

COURSE OUTCOMES:

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

1. Explain the basic concepts of CNC programming and machining.
2. Develop manual part programs for 2D-complex profiles using Fanuc control CNC Simulator.
3. Implement CNC programs for milling and turning machining operations

List of Experiments

1. Manual Part Programming examples in plain turning, step turning, taper turning, contour turning, thread cutting, drilling, boring, taper boring, counter boring, parting off with and without using Canned Cycles and sub programs on CNC Lathe.
2. Manual Part Programming examples in drilling, pocket milling and profile milling with and without using Canned Cycles and sub programs on CNC Milling Machine.
3. Modelling, part program generation and tool path simulation using any one of the CAM software packages like Master CAM, Edge CAM, Ideas, Pro - E, CATIA etc.

ME 352	THERMAL ENGINEERING LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER V [THIRD YEAR]						

COURSE OBJECTIVES:

1. To understand the measurement of properties of oils like Viscosity and its variation with temperature
2. To understand the measurement of Flash, Fire points and Calorific value of given fuels
3. To estimate the performance of I.C. Engines by various tests
4. To estimate the performance of Reciprocating compressor and Rotary Compressor (Centrifugal Blower)

COURSE OUTCOMES:

After Completion of the course, the students are able to

1. Determine the viscosity of given oils by different viscometers
2. Determine the flash, fire points and calorific value of given fuels
3. Determine the various performance parameters of I.C. Engine by conducting load test, heat balance test etc.,
4. Determine the Isothermal and Volumetric efficiencies of Reciprocating compressor & Overall efficiency of blower.

COURSE CONTENT:

S.No.	EXPERIMENTS:	
1.	To determine the viscosity of given oil using Redwood Viscometer I	**CO1**
2.	To determine the Flash and Fire points of given fuel using Cleaveland‟s apparatus	**CO1**
3.	To determine the lower calorific value of given Gaseous fuel(LPG)	**CO2**
4.	To determine the Flash point of given fuel using Able‟s and Pensky Martin‟s apparatus	**CO2**
5.	To determine isothermal and volumetric efficiencies of a two stage reciprocating compressor	**CO4**
6.	To determine the overall efficiency of the Blower test rig(Centrifugal compressor)	**CO4**
7.	To draw VTD and PTD on the given engine models	**CO3**
8.	To conduct load test on single cylinder diesel engine test rig using electrical dynamometer with bulb loading	**CO3**
9.	To conduct Load and Morse test on multi cylinder petrol engine test rig using Hydraulic dynamometer	**CO3**
10.	To conduct load and heat balance test on Twin cylinder diesel engine test rig.	**CO3**
11.	To conduct a load and heat test on Variable compression ratio test rig on single cylinder diesel engine.	**CO3**

TEXT BOOK(S):

1. I.C. Engines - V.Ganesan - T.M.H., New Delhi, 3rdEdition
2. Thermal Engineering -Rajput, Laxmi Publication, New Delhi,2012.

ME 353	SUMMER INTERNSHIP	L	T	P	C	Int	Ext
		0	0	0	1.5	100	-
	SEMESTER V [THIRD YEAR]						

- **A student will be required to submit a summer internship report to the department and appear for an oral presentation before the departmental committee.**

- **The report and the oral presentation shall carry 40% and 60% weightages respectively.**

Course Outcomes:

After completion of the course, the students will be able to

1. Apply theoretical knowledge to practical application
2. Demonstrate good work ethics and attitudes necessary for job success.
3. Demonstrate communication, interpersonal, and other critical skills in the job interview process.
4. Write down, performance objectives (mutually agreed upon by the employer, experiential learning supervisor, and the student) related to their job assignment.

MESL3	SOFT SKILLS	L	T	P	C	Int	Ext
	SKILL ORIENTED COURSE	1	0	2	2	100	--
	SEMESTER VI [THIRD YEAR]						

COURSE OBJECTIVES:

Soft Skills course prepares students to

- Raise awareness of and to develop key competencies to succeed in professional and personal life.
- To demonstrate their team working abilities; and, that they can emerge as leaders while still maintaining the group objectives.
- Prepare resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity and demonstrate ability to target the resume to the presenting purpose.
- Develop confidence in relationship to their interviewing skills.

COURSE OUTCOMES:

By the end of the course students will be able to:

- Develop key competencies to succeed in professional and personal life.
- Identify the key skills and behaviour required to facilitate group discussion
- Produce resume with basic format and inputs to meet the company requirements.
- Identify appropriate verbal and non-verbal communication skills/techniques for an interview including preparedness, professional attire.

COURSE CONTENT:

UNIT-1	CO1	9

Importance of Skills in Professional and Personal life
• Soft Skills Vs Hard Skills
• Personality Development
  ○ Self-Grooming
  ○ SWOT/ SWOC Analysis
  ○ Goal Setting		

UNIT-2	**CO2**	**12**
Communication Skills • Presentation Skills : Mini presentations • Group Discussions (GD Lab) • Types of GDs -How to face GD • Practice Sessions		
UNIT-3	**CO3**	**6**
Resume Writing • Email -Etiquette • Resume Workshop Cover Letter Effective Resume Writing**:** Structure and Presentation		

UNIT-4	CO4	9

Interview Skills

- Facing Interviews**:** Interview Process - Understanding Employer Expectations - Pre-Interview Planning
- Frequently Asked Questions (FAQs)- Opening Strategies - Answering Strategies Mock Interviews

LEARNING RESOURCES:

Reference Books:

- *Mitra, B. K. (2011). Personality development and soft skills. Oxford University Press.*
- *Technical Communication - Principles and Practice, II Ed, OUP by Meenakshi Raman &Sangeetha Sharma, 2015.*
- *Strategies for Engineering Communication – Susan Stevenson and Steve Whitmore, 2002*
- *Group Discussion and Interview Skills by Priyadarshi Patnaik, published by Foundation Books*
- *The Skills of Interviewing: A guide for Managers and Trainers – Leslie Rae*
- *Cambridge English for Job-Hunting by Colm Downes, published by Cambridge University Press*

ME 321	DESIGN OF TRANSMISSION ELEMENTS	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER VI [THIRD YEAR]						

COURSE OBJECTIVES:

1. To introduce design of Shafts, keys and couplings with various types of Loading arrangements for both Strength and Rigidity aspects
2. To make the students to understand the types, construction, design flexible drives like Flat & V belt and selection of Chain Drives.
3. To Study various types of gears, materials, gear forces and comprehend design procedures for design of Spur, Helical, Bevel and Worm gears.
4. To understand the knowledge on the principal parts of an I.C. Engine, standard design procedure of cylinder, piston and connecting rod by using design data handbook.

COURSE OUTCOMES:

At the end of completion of the course, the student will be able to:

1. Design Shafts, keys and couplings subjected to combined loading using theories of failure.
2. Design an appropriate belt or chain drive for the specified application.
3. Design spur, helical, bevel and worm gears using Lewis's beam strength equation.
4. Design cylinder, piston and connecting rod subjected to mechanical and thermal stresses.

COURSE CONTENT:

UNIT-1	CO1	12
Shafts: Design of solid and hollow shafts for strength - For Bending, Torsion, Combined bending and torsion and combined bending, torsion and axial loads. **Keys:** Introduction, Design of square and flat keys **Shaft Couplings**: Rigid couplings - Muff Coupling, Flange coupling, Flexible coupling – Universal Coupling		
UNIT-2	**CO2**	**12**
Belt Drives : Flat and V-belts, Belt constructions, Geometrical relationships, Analysis of belt tensions, condition for maximum power, Selection of V-belts - Selection of Pulleys. **Chain Drives:** Introduction, Chain drives, Advantages of chain drives over belt drives, Polygonal effect, Selection of roller chains.		
UNIT-3	**CO3**	**12**
Spur Gears : Classification of gears, Terminology of spur gear, standard systems of Gear Tooth, Force analysis, Gear tooth failures, Selection of material, Beam Strength of gear teeth, lubrication, Lewis Equation **Helical Gears:** Terminology of helical gears, virtual number of teeth, Tooth proportions, force analysis, Beam Strength of helical gears, effective load on gear tooth, wear strength of helical gears. Lewis Equation. **Bevel Gears and Worm Gears:** Specifications, design of bevel and worm gears.		
UNIT-4	**CO4**	**12**
Design of I.C Engine parts - Cylinder: Introduction, Cylinder liners, Design of a cylinder, Material for cylinder. **Piston and Connecting Rod:** Introduction, Design of trunk type piston and connecting rod.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Design of Machine Elements by V.B. Bhandari, Tata McGraw Hill, 3rd Edition,2017.
2. ***Machine Design by P.C. Sharma & D.K. Agarwal., S.K. Kataria& Sons ,2003.***
3. Design of Machine Elements by C.S. Sharma & K. Purohit ,PHILtd,2005.
4. Machine Design by R.S. Khurmi& J.K. Guptha , S. Chand ,2012.

REFERENCE BOOK(S):

1. Shigley J., Mischke C., Budynas R. and Nisbett K., Mechanical Engineering Design, 8th ed., Tata McGraw Hill, 2010.
2. Jindal U.C., Machine Design: Design of Transmission System, Dorling Kindersley,2010.
3. Maitra G. and Prasad L., Handbook of Mechanical Design, 2nd ed., Tata McGraw Hill, 2001.

HAND BOOKS TO BE ALLOWED IN SEMESTER EXAMINATION:

1. Design data book, P.S.G. College of Tech,Coimbatore
2. Design data book, Mahadevan &Balaveera Reddy - CBSPub

WEB REFERENCE:

1. https://www.machinedesign.com/basics-design/flat-belts
2. http://qtcgears.com/spotlight/plasticgears.php
3. https://www.machinedesign.com/basics-design/internal-combustion-engines

ME 322	OPERATIONS RESEARCH	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER V [THIRD YEAR]						

COURSE OBJECTIVES:

1. Grasp the methodology of OR problem solving and formulate linear programming problem.
2. Develop formulation skills in transportation models and assignment problems and finding solutions
3. Understand the basics in the field of dynamic programming and theory of games
4. Basic understanding of inventory and simulation

COURSE OUTCOMES:

After completion of the course, the students will be able to

1. Determine the optimal solution for Linear Programming Problem by simplex method.
2. Solve the problems on network models such as Transportation and Assignment Problems
3. Determine the best strategy and value of the given game model
4. Apply dynamic programming to problems of discrete and continuous variables
5. Solve deterministic inventory control models for known demand of the items.
6. Apply Monte-Carlo simulation to inventory and queuing problems

COURSE CONTENT:

UNIT-1	CO1	12
Linear Programming : Definition and Scope of Operations Research, Mathematical formulation ofthe problem, graphical method, Simplex method, artificial basis technique, duality, dual Simplex method. Degeneracy, alternative optima, unbounded solution, infeasible solution.		
UNIT-2	**CO2**	**12**
Transportation Problem: Introduction to the problem, LP formulation of a transportation problem. Basic feasible solution by north-west corner method, Vogel‟s approximation method, least cost method. Finding optimal solution by MODI method, degeneracy, unbalanced transportation matrix and Maximization in transportation model. **Assignment Problem:** One-to-one assignment problem, optimal solution, unbalanced assignmentmatrix. Traveling salesman problem. Maximization in assignment problem.		
UNIT-3	**CO3,4**	**12**
Theory of games: Introduction, Rectangular two-person zero person games, solution of rectangular games in terms of mixed strategies, solution of 2x2 games without saddle points, concept of dominance to reduce the given matrix, graphical method for 2xn and nx2 games. **Dynamic programming:** Introduction, Characteristics of D.P. model, the recursive equation approach, solution of an L.P. by D.P		
UNIT-4	**CO 5,6**	**12**
Inventory: Introduction, Basic EOQ, Deterministic continuous review models, Economic production quantity model, Basic EOQ model with shortages, Quantity discounts, Re-order point, buffer stock, reserve stock and safety stock **Simulation:** Introduction, definition and applications. Monte Carlo simulation. Application problems in queuing and inventory**.**		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Introduction to Operations Research - Phillips, Ravindran, James Soldberg Wiley1976.
2. Operations Research - H.A. Taha , Pearson , 7th Edition, June2002.
3. Operations Research - Gupta and Hira , S. Chand ,2008

REFERENCE BOOK(S):

- Introduction to Operations Research - Hiller and Liberman , MGH , 7th Edition ,2002.
- Operations Research - R. Pannerselvam , PHI , 2nd Edition,2006.
- Quantitative techniques for management - V.Vohra , TMH , 3rdEdition.
- Optimization Theory and Applications - S.S. Rao, Wiley1979.
- Operations Research - S.D. Sharma, Kedar nath Ram nath & Co, 11th Edition ,2002.

ME 323	HEAT TRANSFER	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER VI [THIRD YEAR]						

COURSE OBJECTIVES:

1. To enable the student to distinguish among the three modes of Heat Transfer and prepare mathematical model of the problem with appropriate boundary conditions.
2. To enable the student to analyse the transient heat conduction systems and to learn the basics of forced convective heat transfer and utilize analogies to solve forced convective heat transfer Problems.
3. To enable the student to analyse natural convection problems and design Heat exchanging equipment.
4. To enable the students to understand fundamentals of radiation and estimate the radiation heat transfer between the bodies.

COURSE OUTCOMES:

After completion of the course, the students are able to

1. Determine the heat transfer rate for one-dimensional steady-state conduction, fins, and lumped systems.
2. Compute forced and natural convection heat transfer for specified flows.
3. Determine the heat exchanger performance for specified configurations.
4. Compute radiation heat transfer between different bodies.

COURSE CONTENT:

UNIT-1	**CO1**	**12**
Introduction: Basic Modes and Laws of Heat transfer, thermal conductivity, Steady state Heat Conduction, General conduction equation in Cartesian and Cylindrical coordinates. **One-Dimensional Steady State Heat Conduction:** Heat flow through plane wall and cylinder with constant thermal conductivity, Heat flow through composite slab and Cylinders, Thermal resistance, Electrical analogy, Thermal contact resistance, problems on variable thermal conductivity, critical insulation thickness, uniform heat generation in slabs. **Extended Surfaces**: Types, Applications, Fin materials, Heat transfer from fins with uniform cross section, Fin efficiency and Effectiveness.		
UNIT-2	**CO1,2**	**12**
Transient Heat Conduction: (One dimensional only) - Lumped heat capacity systems. **Forced Convection: External flows:** Introduction, Principles of convection, Mass, Momentum and Energy equations for boundary layer, Hydrodynamic and thermal boundary layers and their thicknesses, concept of turbulence. Correlations for heat transfer in Laminar and Turbulent flows over a flat plate, relation between fluid friction and heat transfer in laminar flows -Reynolds-Colburn Analogy. **Forced convection: Internal flows:** Division of internal flow through concepts of Hydrodynamic and thermal entry lengths – Use of empirical relations for convective heat transfer in horizontal pipe flow.		
UNIT-3	**CO2, 3**	**12**
Natural Convection: Mechanism of natural convection, velocity and temperature profiles over a vertical plate. Correlations for vertical plates, horizontal plates, vertical and horizontal cylinders, inclined surfaces – Problems. **Heat Exchangers:** Classification, types of heat exchangers, Flow arrangement, Temperature distribution, Overall heat transfer coefficient, Fouling factor, LMTD and NTU methods of Heat exchanger analysis, correction for LMTD for use with multi pass and cross flow Heat Exchangers, Effectiveness.		

UNIT-4	CO4	12
Radiation: Fundamentals of Radiation: Basic Concepts and definitions, Absorptivity, Reflectivity, Transmissivity, concept of Black body, Laws of Radiation, Kirchhoff's law, Planck's law, Wein's law, Stefan Boltzmann's law, solid angle and Intensity of radiation, Lambers cosines law. **Radiant Heat Transfer:** The View factor and relations, Radiation heat transfer between two finite Black surfaces, Radiation Heat transfer between two finite diffuse gray surfaces, Radiation heat transfer between two large parallel plates, Radiation shields.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Heat and Mass Transfer – Yunus A. Cengel and Afshin J.Ghajar, MC Graw Hill Education (Idia) Private Limited, New Delhi ,2014.
2. Heat and Mass Transfer - Sachdeva, New Age India, New Delhi,2009.
3. Heat Transfer-Rajput, Laxmi Publ, NewDelhi,2011.

REFERENCE BOOK(S):

1. Heat transfer - J.P.Holman, MGH, New York , 6thEdition.
2. Heat transfer - S.P.Sukhatme, TMH,2009.

WEB REFERENCE:

1. IIT Video Lectures(NPTEL)
2. http://www.wisc-online.com/Objects/ViewObject.aspx?ID=SCE304
3. http://web.cecs.pdx.edu/~gerry/heatAnimations/sphereTransient/#TOC
4. http://rpaulsingh.com/animated%20figures/animationlisttopic.htm
5. http://www.slideshare.net/meenng/transfer-of-heat
6. http://www.phy.cuhk.edu.hk/contextual/heat/hea/heatp01_e.html

ME 324	PROFESSIONAL ELECTIVE-II	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER VI [THIRD YEAR]						

Professional Elective Courses

Design	Thermal	Production	Industrial
MEEL1 Computer Aided Design	MEEL6 I C Engines and Gas Turbines	MEEL12 Automation in Manufacturing	MEEL17 Product Lifecycle Management
MEEL2 Finite element Methods	MEEL7 Refrigeration and Air Conditioning	MEEL13 Introduction Composite Materials	MEEL18 Industrial Management
MEEL3 Mechatronic System Design MEEL4 Fluidics and control systems	MEEL8 Automobile Engineering MEEL9 Elements of Aerospace Engineering	MEEL14 Advanced Metal Casting	MEEL19 Process Planning and Cost Estimation
MEEL5 Industrial Robotics	MEEL10 Power Plant Engineering MEEL11 Energy Conservation & Management	MEEL15 Safety in Engineering Industry MEEL16 Maintenance Engineering	MEEL20 Total Quality Management

Note: Syllabus given in professional electives section of book

ME 325	OPEN/ JOB ORIENTED ELECTIVE – II	L	T	P	C	Int	Ext
		2	-	2	3	30	70
	SEMESTER VI [THIRD YEAR]						

Open Elective Courses (Offered by other Departments)

Code No.	Subject Name	Code No.	Subject Name
CEOL1	Basic Surveying	CEOL2	Building Materials and Construction
CHOL1	Energy Engineering	CHOL2	Solid Waste Management
CSOL1	Programming with Java	CSOL2	Relational Database Management Systems
CBOL1	Operating Systems Concepts	CBOL2	Business Analytics
CMOL1	Fundamentals of Artificial Intelligence	CMOL2	Programming with C++
CDOL1	Python for Data Science	CDOL2	Data Science for Engineers
COOL1	Architecting Smart IoT Devices	COOL2	Fog Computing
ECOL1	Applied Electronics	ECOL2	Microprocessors & Interfacing
ECOL3	Linear ICs and Applications	EEOL1	Renewable Energy Sources
EEOL2	Utilization of Electrical Energy	ITOL1	Data Structures & Algorithms
ITOL2	Web Technologies		

Job Oriented Elective Courses

Course Code	Course Name	Course Code	Course Name
JOEL01	Big Data Processing	JOEL12	Building Planning
JOEL02	Full Stack Development	JOEL13	Quantity Estimation
JOEL03	JavaScript Technologies	JOEL14	Bio Fuels
JOEL04	Cloud Computing using AWS	JOEL15	Environmental Engineering
JOEL05	DevOps	JOEL16	Safety Management
JOEL06	Enterprise Programming	JOEL17	Non-Conventional Energy Engineering
JOEL07	Predictive Modeling and Analysis	JOEL18	Biopharmaceutics and Drug Design
JOEL08	Data warehousing and mining	JOEL19	Embedded Systems-1
JOEL09	Interface and Programming With IoT Gateway	JOEL20	Embedded Systems-2
JOEL10	IoT Cloud and Data Analytics	JOEL21	Open Source Systems
JOEL11	Geospatial Technology	JOEL22	Machine Learning

Note: Syllabus given in open electives section of book.

ME 361	DESIGN & METROLOGY LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER VI [THIRD YEAR]						

COURSE OBJECTIVES:

1. To impart the knowledge regarding importance of accuracy & precision whiletaking the measurements
2. Students are exposed to measuring the dimensions of mechanical components.
3. Students are provided the basic knowledge about alignment of machine tools.
4. Students are exposed to measure the cutting forces with the help of dynamometers.
5. Students are exposed to know the importance of surface finish.

COURSE OUTCOMES:

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

1. Demonstrate the working of instruments for measuring internal, external angles, dimensions and surface roughness.
2. Examine alignment of various machine tools.
3. Explain the various design principles practically.
4. Write the working principle of various types design instruments

LIST OF EXPERIMENTS

1. Angle and taper measurement by Bevel Protractor & Sine Bar
2. Internal and external taper measurement using Ball &Rollers
3. Measuring effective dia. of thread using 2 wire, 3 wire method
4. Measuring gear tooth thickness using gear tooth vernier
5. Measuring internal dia. using bore dial gauge
6. Measurement of Circularity, Cylindricity, Flatness and straightness using CMM
7. Alignment test on Lathe, Drilling, Milling machines
8. Measuring external diameters using Micrometer & Plot X & R Charts
9. Measurement of surface finish using surf tester
10. Measuring different parameters of a thread / gear using tooth profile projector
11. Vibration measurements
12. Gyroscope
13. Balancing
14. Whirling of shafts

Note: Any Ten Experiments should be performed.
Pre-Requisites: Engineering Metrology, Mechanical measurements.

ME 362	HEAT TRANSFER LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER VI [THIRD YEAR]						

COURSE OBJECTIVES:

1. To understand the measurement of performance of refrigeration tutor and air conditioning tutor
2. To understand the estimation of heat transfer rate in conduction mode of heat transfer
3. To understand the effectiveness of heat transfer rate through heat exchanger in a different flow conditions
4. To understand the estimation of heat transfer rate in convection & radiation mode of heat transfer

COURSE OUTCOMES:

After Completion of the course, the students are able to

1. Determine the COP and Capacity of the refrigeration and air conditioning setup.
2. Determine the heat transfer rate in Pin Fin, Metallic bar, vertical rod and lagged pipe setups.
3. Determine the overall heat transfer coefficient & effectiveness of heat exchanger in parallel flow and counter flow conditions.
4. Determine heat transfer rate in Emissivity and Stefan-Boltzmann setups.
5. Determine the vehicle speed and steering ratios of an automobile.

COURSE CONTENT:

S.No.	EXPERIMENTS:	
1.	Refrigeration Test Rig.	**CO1**
2.	Air-Conditioning Test Rig.	**CO1**
3.	Heat Exchanger Parallel & Counter flows.	**CO3**
4.	Emissivity apparatus.	**CO4**
5.	Pin Fin-Natural convection and Forced convection	**CO4**
6.	Natural convection on Vertical cylinder.	**CO4**
7.	Stefan-Boltzman „s apparatus	**CO4**
8.	Axial conduction on metal bar.	**CO2**
9.	Lagged pipe apparatus.	**CO2**
10.	Automobile chassis- steering and transmission system.	**CO1**
11.	Composite slab	**CO2**

TEXT BOOK(S):

1. Heat and Mass Transfer – Yunus A. Cengel and Afshin J.Ghajar, MC GrawHill
2. Heat Transfer-Rajput, Laxmi Publ, NewDelhi,2011.

ME 363	ANALYSIS LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER VI [THIRD YEAR]						

COURSE OBJECTIVES:

1. Learn practical application of FEA using the ANSYS software
2. Learn the proper use of ANSYS code
3. Build computer models or transfer CAD models of structures, products, components or systems.
4. Apply operating loads or other design performance conditions. Study the physical responses, such as stress levels, temperature distribution etc.

COURSE OUTCOMES:

After Completion of the course, the students are able to

1. Demonstrate the basics of ANSYS capabilities, terminology and the GUI
2. Acquire the knowledge in building solid models & meshing, apply loads, solving & reviewing results
3. Model the component to find stress, temperature distribution etc., with the help of suitable boundary conditions.
4. Solve various engineering problems in structural, thermal and fluid mechanics

The following analysis can be performed by using any of the analysis soft wares like ANSYS (APDL/ WORKBENCH) , ALGOR, NASTRAN, NISA, ABAQUS etc.,

LIST OF EXPERIMENTS

1. **STATIC ANALYSIS: Truss and Frame Structures**
   2-D truss, 3-D truss, Beam analysis
2. **STATIC ANALYSIS: Two Dimensional Problems**
   2-D structure with various loadings, 2-D structures with different materials, Plate with hole
3. **DYNAMIC ANALYSIS: Modal And Transient Analyses**
   Modal analysis of Solid Structure, Transient Response
4. **NON-STRUCTURALPROBLEMS**
   Steady State heat transfer, Transient heat transfer, Fluid Analysis

LEARNING RESOURCES:

REFERENCES:

1. Introduction to Finite elements in Engineering by Chandrupatla & Belegundu, PHI,2010.
2. www.mece.ualberta.ca.
3. Ansys , " Multiphysics User'sManual"

MESL4	Advanced Modeling Lab (Automotive Domain)	L	T	P	C	Int	Ext
	SKILL ORIENTED COURSE	1	0	2	2	100	--
	SEMESTER V [THIRD YEAR]						

COURSE OBJECTIVES:

1. To provide the students with the knowledge and techniques of the research and application of CAD/CAM.
2. To create 3D part geometry using the design module of the modeling
3. To develop the skills in CAD operations to visualize and create three dimensional part models of mechanical components and assemblies.
4. Student will be able to produce CAD drawings which communicate the appropriate manufacturing details, standards, and specifications

COURSE OUTCOMES:

At the end of the course, the student will be able to:

1. Express Product Design Ideas using 3D sketches
2. Model the components with geometric specifications using surface and wireframe modules
3. Model engineering components using generative sheet metal modeling techniques.
4. Apply parametric modeling technique to automobile components

EXPERIMENTS:

1. Introduction to Vehicle Architecture.
2. Body in White
3. Power Train
4. Interior Trims
5. Chassis Design
6. Exterior Design

LEARNING RESOURCES:

TEXT BOOK(S):

1. Bhatt N.D., Panchal V.M. & Ingle P.R. - Engineering Drawing, Charotar Publishing House, 2014.
2. "Machine Drawing" by K. L. Narayana, P. Kannaiah, K. Venkata Reddy , New Age International , 2007.
3. “CAD Modeling Essentials in 3DEXPERIENCE 2016x Using CATIA Applications”, Nadar Zamani, 2017

WEB REFERENCE:

1. https://edu.3ds.com/en/learn-online

IV YEAR

ME 411	HUMANITIES ELECTIVE-I	L	T	P	C	Int	Ext
		3	0	-	3	30	70
	SEMESTER VII [FOURTH YEAR]						

Humanities Elective Courses

Code No.	Subject Name
HSEL01	Industrial Management & Entrepreneurship
HSEL02	Economics for Engineers
HSEL03	Introduction to Industrial Management
HSEL04	Project Management & Entrepreneurship

Note: Syllabus given in humanities electives section of book.

ME 412	PROFESSIONAL ELECTIVE-III	L	T	P	C	Int	Ext
		3	0	-	3	30	70
	SEMESTER VII [FOURTH YEAR]						

Professional Elective Courses

Design	Thermal	Production	Industrial
MEEL1 Computer Aided Design	MEEL6 I C Engines and Gas Turbines	MEEL12 Automation in Manufacturing	MEEL17 Product Lifecycle Management
MEEL2 Finite element Methods	MEEL7 Refrigeration and Air Conditioning	MEEL13 Introduction Composite Materials	MEEL18 Industrial Management
MEEL3 Mechatronic System Design MEEL4 Fluidics and control systems	MEEL8 Automobile Engineering MEEL9 Elements of Aerospace Engineering	MEEL14 Advanced Metal Casting	MEEL19 Process Planning and Cost Estimation
MEEL5 Industrial Robotics	MEEL10 Power Plant Engineering MEEL11 Energy Conservation & Management	MEEL15 Safety in Engineering Industry MEEL16 Maintenance Engineering	MEEL20 Total Quality Management

Note: Syllabus given in professional electives section of boo

ME 413	PROFESSIONAL ELECTIVE-IV	L	T	P	C	Int	Ext
		3	0	-	3	30	70
	SEMESTER VII [FOURTH YEAR]						

Professional Elective Courses

Design	Thermal	Production	Industrial
MEEL1 Computer Aided Design	MEEL6 I C Engines and Gas Turbines	MEEL12 Automation in Manufacturing	MEEL17 Product Lifecycle Management
MEEL2 Finite element Methods	MEEL7 Refrigeration and Air Conditioning	MEEL13 Introduction Composite Materials	MEEL18 Industrial Management
MEEL3 Mechatronic System Design MEEL4 Fluidics and control systems	MEEL8 Automobile Engineering MEEL9 Elements of Aerospace Engineering	MEEL14 Advanced Metal Casting	MEEL19 Process Planning and Cost Estimation
MEEL5 Industrial Robotics	MEEL10 Power Plant Engineering MEEL11 Energy Conservation & Management	MEEL15 Safety in Engineering Industry MEEL16 Maintenance Engineering	MEEL20 Total Quality Management

Note: Syllabus given in professional electives section of book.

ME 414	PROFESSIONAL ELECTIVE-V	L	T	P	C	Int	Ext
	MOOCS	3	0	-	3	30	70
	SEMESTER VII [FOURTH YEAR]						

- A candidate shall complete two MOOC courses (One from Professional Elective course and another from Open Elective course) of 8/12 weeks in duration.
- Enrolment of MOOC course will be initiated from the date of commencement of class work for Semester V [Third Year].
- MOOC course completion certificate(s) must be submitted on or before the last instruction day of Semester VII [Fourth Year] to consider it for Regular evaluation. Otherwise it will be considered as Supplementary.
- Candidate has to pursue and acquire a certificate for a MOOC course only from the organizations / agencies approved by the concerned BoS in order to earn the 3 credits. List of organizations offering MOOC courses / List of courses will be announced by the respective Board of Studies at the time of commencement of class work for Semester V [Third Year].

ME 415	OPEN/JOB ORIENTED ELECTIVE – III	L	T	P	C	Int	Ext
		2	-	2	3	30	70
	SEMESTER VII [FOURTH YEAR]						

Open Elective Courses (Offered by other Departments)

Code No.	Subject Name	Code No.	Subject Name
CEOL1	Basic Surveying	CEOL2	Building Materials and Construction
CHOL1	Energy Engineering	CHOL2	Solid Waste Management
CSOL1	Programming with Java	CSOL2	Relational Database Management Systems
CBOL1	Operating Systems Concepts	CBOL2	Business Analytics
CMOL1	Fundamentals of Artificial Intelligence	CMOL2	Programming with C++
CDOL1	Python for Data Science	CDOL2	Data Science for Engineers
COOL1	Architecting Smart IoT Devices	COOL2	Fog Computing
ECOL1	Applied Electronics	ECOL2	Microprocessors & Interfacing
ECOL3	Linear ICs and Applications	EEOL1	Renewable Energy Sources
EEOL2	Utilization of Electrical Energy	ITOL1	Data Structures & Algorithms
ITOL2	Web Technologies		

Job Oriented Elective Courses

Course Code	Course Name	Course Code	Course Name
JOEL01	Big Data Processing	JOEL12	Building Planning
JOEL02	Full Stack Development	JOEL13	Quantity Estimation
JOEL03	JavaScript Technologies	JOEL14	Bio Fuels
JOEL04	Cloud Computing using AWS	JOEL15	Environmental Engineering
JOEL05	DevOps	JOEL16	Safety Management
JOEL06	Enterprise Programming	JOEL17	Non-Conventional Energy Engineering
JOEL07	Predictive Modeling and Analysis	JOEL18	Biopharmaceutics and Drug Design
JOEL08	Data warehousing and mining	JOEL19	Embedded Systems-1
JOEL09	Interface and Programming With IoT Gateway	JOEL20	Embedded Systems-2
JOEL10	IoT Cloud and Data Analytics	JOEL21	Open Source Systems
JOEL11	Geospatial Technology	JOEL22	Machine Learning

Note: Syllabus given in open electives section of book.

ME 415	OPEN ELECTIVE - IV	L	T	P	C	Int	Ext
	MOOCS	2	-	2	3	30	70
	SEMESTER VII [FOURTH YEAR]						

- A candidate shall complete two MOOC courses (One from Professional Elective course and another from Open Elective course) of 8/12 weeks in duration.
- Enrolment of MOOC course will be initiated from the date of commencement of class work for Semester V [Third Year].
- MOOC course completion certificate(s) must be submitted on or before the last instruction day of Semester VII [Fourth Year] to consider it for Regular evaluation. Otherwise it will be considered as Supplementary.
- Candidate has to pursue and acquire a certificate for a MOOC course only from the organizations / agencies approved by the concerned BoS in order to earn the 3 credits. List of organizations offering MOOC courses / List of courses will be announced by the respective Board of Studies at the time of commencement of class work for Semester V [Third Year].

ME 451	INDUSTRIAL/RESEARCH INTERNSHIP	L	T	P	C	Int	Ext
		-	-	-	3	100	--
	SEMESTER VII [FOURTH YEAR]						

- A student will be required to submit a summer internship report to the department and appear for an oral presentation before the departmental committee.

- The report and the oral presentation shall carry 40% and 60% weightage respectively.

Course Outcomes:

After completion of the course, the students will be able to

1. Apply theoretical knowledge to practical application
2. Demonstrate good work ethics and attitudes necessary for job success.
3. Demonstrate communication, interpersonal, and other critical skills in the job interview process.
4. Write down, performance objectives (mutually agreed upon by the employer, experiential learning supervisor, and the student) related to their job assignment.

MESL5	AUTOMATION LAB	L	T	P	C	Int	Ext
	SKILL ORIENTED COURSE	1	0	2	2	100	--
	SEMESTER VII [FOURTH YEAR]						

This lab imparts skill and knowledge on Industrial automation with an exclusive training on hardware and software components to automate industrial and commercial applications.

COURSE OBJECTIVES:

1. To introduce basics of C-Prog robot simulation software and make students to write programs.
2. To introduce concepts of PLC and make students to simulate PLC ladder programing.
3. To get practical exposure on Industrial CNC machines.
4. To make students build prototypes with the exposure of 3D Printing technology

COURSE OUTCOMES:

Students are able to

1. Execute different motion commands and perform different tasks using C-Prog Software.
2. Execute PLC ladder programming related to counters, timers and latching concepts.
3. Work on industrial CNC machine.
4. Build prototypes of their own design using 3D printing machines.

LIST OF EXERCISES:

1. Demonstration of Robot with 4 DOF Manipulator
2. Two Programming Exercises for Robots
3. Introduction to plc programming simulation.
4. Programming plc using of counters, timers and latching circuits.
5. Two exercises on CNC vertical machining centre
6. Two exercises on 3D printing machine.
7. Develop a product using Automation

ME 461	PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY	L	T	P	C	Int	Ext
		-	-	-	12	30	70
	SEMESTER VIII [FOURTH YEAR]						

- In the final semester, the student should mandatorily undergo internship and parallelly he/she should work on a project with well-defined objectives.
- At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

Course Outcomes:

After successful completion of the course, the students are able to

1. Identify a topic in advanced areas of Mechanical Engineering
2. Review the literature to identify gaps
3. State the objectives & scope of the work
4. Develop a prototype/model, experimental set-up, and software systems to meet the objectives
5. Analyze the results for valid conclusions
6. Assess the possibility of publishing papers in peer reviewed journals/conference Proceedings