R.V.R. & J. C. COLLEGE OF ENGINEERING

(Autonomous)

Accredited by NBA and NAAC with "A" Grade

Chandramouli Puram :: Chowdavaram :: GUNTUR – 522019.

Regulations [R-16]
Scheme of Instruction,
Examinations and Syllabi

[Four Year B.Tech. Degree, w.e.f. 2016-17]

MECHANICAL ENGINEERING

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.

The Mission

An integrated development of manpower possessing technological and managerial knowledge and skills, values and ethics needed to make an honorable living and contribute to the socio-economic development and welfare of the society.

The Genesis and Growth

Like all great institutions, the College too had a humble beginning with just 180 intake and a barely adequate infrastructure in1985, it is the determination and commitment of the Management that made the College one of the largest among Engineering Institutions in South India with excellent infrastructure, facilities and competent human resources. Today, it offers eight B.Tech., Degree Courses with an intake of 1080 plus 216 through lateral entry into the II Year for Diploma Holders. Further, the College offers MBA, MCA and M.Tech. in six specializations with an intake of 355. The total intake is 1435.

In 1998 it has become the youngest College to have been accredited and as on date all the seven eligible B.Tech. Degree Courses have been accredited in 2002, 2007 and again in 2012. It has become the first Engineering College in the state to have been accredited fourth time by N.B.A., New Delhi. In 2014, the Institution was accredited by NAAC with 'A' Grade for FIVE Years by getting 3.19 CGPA on 4 point Scale. Further in the Academic Audit and Grading done by Andhra Pradesh State Council for Higher Education, Govt. of A.P., the institute is rated as the SECOND best among Private

Engineering Colleges of A.P. and FOURTH best amongst all Engineering Colleges of A.P. including University Engineering Colleges. It has also figured among the "Top-100"Engg. Colleges in independent surveys conducted in 2006 & 2007 by the popular magazine the "OUTLOOK". The College received Best Laboratory Award, Eco Friendly Campus and First Prize for Best Performing Professional UG College in University Examination Results for the last FIVE consecutive years from Acharya Nagarjuna Universioty. The College is a typical example of meticulous planning, resource scheduling, human endeavor and institutional management.

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

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 way to 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 diversity in specialization and heterogeneity in abilities have unity in their objective of enriching the 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 more on 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 of behavior 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 educational

films 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 providing internet 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 600+ in 2015-16.

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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 to inculcate human values and concern for environment and the society.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

Upon graduation, the students of the program will

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

PEO II : 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.

PEO III: Strive to achieve full potential and expand their capabilities through harnessing multidisciplinary skills and to analyze engineering issues in a broader perspective with ethical responsibility towards sustainable development.

PEO IV: Enhance knowledge and skills in the areas of interpersonal activities, leadership and team building to achieve organization goals, and the ability to constantly adapt and change through lifelong learning.

PROGRAM OUTCOMES (PO)

Engineering Graduates will be able to:

PO 1: **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: **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.

PO 3 : **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.

PO 4: **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.

PO 5: **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.

PO 6: **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.

PO 7: **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.

PO 8: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: **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.

PO 11: **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.

PO 12: **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.

PROGRAM SPECIFIC OUTCOMES (PSO)

The Program "Mechanical Engineering" curriculum must prepare the students

PSO 1: an ability to utilize their knowledge in engineering, basic sciences and mathematics on an applied basis.

PSO 2: an ability to apply learned principles to the analysis, design development and implementation of more advanced mechanical systems or processes

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 and accredited Fourth time in July, 2012. The Department was well established and running successfully with an intake of 180 Students.

Mechanical Engineering is a challenging discipline. 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.

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 is 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

The Department has 5 Professors all with Doctorate, 7 Associate Professors with six are Doctorate and one submitted thesis for evaluation. 35 Assistant Professors with one doctorate. 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 four of them are going to submit the thesis for Ph.D. Nine 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 Nagrajuna University, SV University, JNTUK...Etc. and guiding many scholars. The faculty are also the members of various professional societies at national and international level.

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.

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 130 computer systems with Pentium IV, a server and latest and advanced Software like AutoCAD, Mechanical Desktop, CATIA, MSC Nastran, Autodesk Inventor, CAEFEM, ANSYS, Pro E, CadianMech-2002. 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 18 P-IV latest systems and Mechatronics equipment, which enable the students to learn principles of equipment and simulation software.

A total of Rs. 80 Lakhs 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. It is also not an out of place to mention that the department has a Research Centre approved by Acharya Nagarjuna University.

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.

The Department library has 750 Text Books, 20 Video Cassettes, 28 Journals, NPTEL video Lectures and 500 Project Work Reports in its stock. It caters to the needs of students for good text books and reference books in various subjects.

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)

CHOICE BASED CREDIT SYSTEM REGULATIONS (R-16) FOR
Four Year BACHELOR OF TECHNOLOGY (B.Tech.) Degree Program

(w.e.f. the batch of candidates admitted into First Year B.Tech. from the academic year 2016-2017).

1 MINIMUM QUALIFICATIONS FOR ADMISSION

A candidate seeking admission into I Year of B.Tech. Degree Course 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 II Year of B.Tech. Degree Course 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 & Engineering
4. Electrical & Electronics Engineering
5. Electronics & Communication Engineering
6. Information Technology
7. 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 II 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 OFFERED

5.1 A candidate has to register and secure 189 credits out of which 54 credits from laboratory courses including project work.

5.2 A candidate has to register 12 courses in First, Second and Third Years of study and 10 courses

in Fourth year of study.

5.3 A candidate can register for a minimum of 5 courses and maximum of 7 courses in each semester of II Year, III Year and IV Year I Semester of study.

5.4 National Cadet Corps (NCC) / National Service Organisation (NSO) / National Service Scheme (NSS) Requirements:

- All candidates admitted to the B.Tech. programme will have to take either NCC or NSO or NSS as an extra-curricular programme.
- The NCC / NSO / NSS programme will be held as announced by the respective Co-ordinator(s).
- The NCC / NSO / NSS requirements should be completed before III Year II Semester.
- Enrollment of NCC / NSO / NSS programme will be inititated from the date of commencement of class work for II Year I Semester.
- NCC / NSO / NSS certificate must be submitted on or before the last instruction day of III Year II Semester, otherwise his / her Semester End Examination results will not be declared.

5.5 MOOCS (Massive Open Online Courses) Requirements:

- Enrollment of MOOCS course will be inititated from the date of commencement of class work for III Year I Semester.
- MOOCS course completion certificate must be submitted on or before the last instruction day of IV Year I Semester, otherwise his / her Semester End Examination results will not be declared.
- List of organisations offering MOOCS course(s) will be announced by the respective Board of Studies at the time of commencement of class work for III Year I Semester.

5.6 Internship / Industrial Trainning / Certification Course :

- Enrollment of Internship / Industrial Trainning / Certification Coursewill be inititated from the end of II Year II Semester.
- Internship / Industrial Trainning / Certification Course completion certificate must be submitted on or before the last instruction day of IV Year I Semester, otherwise his / her Semester End Examination results will not be declared.

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 / Practical	40	60
Mini Project / Term paper	100	---
Project work	40	60 (Viva voce)

6.2 In each of the Semesters, there shall be two Mid Term examinations and two Assignment Tests in every theory course. The Sessional marks for the midterm examinations shall be awarded giving a weightage of 15 marks out of 18 marks (80% approx.) to that midterm examination in

which the candidate scores more marks and the remaining 3 marks (20% approx.) for other midterm examination in which the candidate scores less marks. Similarly a weightage of 10 marks (80% approx.) out of 12 marks earmarked for assignment tests shall be given for the assignment in which the candidate scores more marks and remaining 2 marks (20% approx.) shall be given for the assignment test 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 5 marks out of the 40 marks earmarked for the sessional marks are awarded (quiz / online examination) by the concerned teacher in the respective theory courses.

6.3 The evaluation for Laboratory class work consists of a weightage of 25 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 day-to-day progress, the performance in two Seminars and the Project Report submitted at the end of the semester. The allotment of sessional marks for Seminars and day-to-day work shall be 15 and 25 respectively.

NOTE : A candidate who is absent for any Assignment / Mid Term 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.

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 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 average attendance of 75% in all the courses computed by totalling the number of hours / periods of lectures, design and / or drawing, practical'sand 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 40 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% - 1 mark

Attendance of 80% and above but less than 85% - 2 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.

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.

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.

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 / Practical Courses. Each theory course is awarded three credits and each practical course is awarded two credits. Project work is awarded eight credits. The total number of credits for all Four years put together shall be 189.

12.2 AWARD OF GRADES

S.No.	Range of Marks	Grade	Grade Points
1.	≥ 90	S	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 (subsequently changed into pass or E to S or F grade in the same semester)	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 A candidate who has earned 'F'grade in any course can repeat the course by re-registering it when the course is offered next time.

12.5 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: $$\frac{\sum[\text{No.of credits} \times \text{Grade points}]}{\sum \text{No.of Credits}}$$

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

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

12.7 Conversion of CGPA into equivalent Percentage.: Percentage of Marks = 9.25 x CGPA

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 III Year, if he / she secures a minimum of 70% of the total number of credits of I Year by the time the classwork commences for III Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in ***Clauses 6 and 8*** in II Year II Semester.

13.3 A candidate shall be eligible for promotion to IV Year, if he / she secures a minimum of 70% of the total number of credits of I & II Years put together, by the time the classwork commences for IV Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in ***Clauses 6 and 8*** in III Year II Semester.

13.4 A candidate (Diploma Holder) admitted under lateral entry into II Year, shall be eligible for promotion to IV Year, if he/she secures a minimum of 70% of the total number of credits of II & III Year put together by the time the classwork commences for IV Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in ***Clauses 6 and 8*** in III Year II Semester.

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 **Maximum Time Limit for completion of B.Tech Degree**

A candidate, who fails to fulfil all the academic requirements for the award of the 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 II B.Tech., who fails to fulfil all the academic requirements for the award of the 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	8.0 or more

2	First Class	6.5 or more but less than 8.0
3	Second Class	5 or more but less than 6.5

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 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 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 SUPPLEMENTARY EXAMINATIONS

18.1 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.

18.2 Instant examination will be conducted immediately after the declaration of IV Year II Semester results for those candidates who cleared all courses except one course in IV Year II Semester.

19 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.

19.1 A candidate, studied under R-12 regulations of RVR & JCCE (Autonomous) curriculum, detained due to lack of academics/attendance at the end of the II Year I Semester, shall join in II Year I Semester of R-16 regulations. The candidate has to clear all the I B.Tech. backlog courses, if any, by appearing the supplementary examinations, conducted by the college under R-12 curriculum. The class will be awarded based on the academic performance of the candidate, such candidates will be considered on par with lateral entry candidates of R-16 regulations and will be governed by regulations applicable to lateral entry candidates'category.

19.2 A candidate, studied under R-12 regulations of RVR & JCCE (Autonomous) curriculum, detained due to lack of academics / attendance at the end of the II Year II Semester and also at the subsequent semesters will follow the same R-12 regulations/curriculum and he/she has to complete all the courses by appearing in the examination conducted by the college under R-12 curriculum. The class will be awarded based on the academic performance of the candidate as per R-12 regulations.

19.3 A candidate, transferred from other institutions / universities into I Year II Semester and also at the subsequent semesters of B.Tech., shall join at appropriate semester of R-16 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-16 circulum courses / equivalent courses. The equivalent courses will be decided by concerned Board of Studies.

20 CONDUCT AND DISCIPLINE

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

20.2 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.

20.3 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'sareas 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.

20.4 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.

20.5 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.

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

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

20.8 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.

20.9 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 "Grievanceand Redressal Committee"(General) constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters.

21 MALPRACTICES

21.1 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.

21.2 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.

22 AMENDMENTS TO REGULATIONS

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

0 - x - 0 - x - 0

R V R & J C COLLEGE OF ENGINEERING, CHOWDAVARAM, GUNTUR-19

(Autonomous)

(w.e.f. the batch of students admitted during the academic year 2016-2017)

B.Tech. in Mechanical Engineering

I Year I Semester):

S. No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of SemEnd Exam.(hrs)	Sessional Marks	Semester End Exam. Marks	Credits	
1	EC/EE/ME 101 Differential Equations And Statistics	3+1		3	40	60	3	BS
2	102 Engineering Physics (common to all branches)	4	-	3	40	60	3	BS
3	103 Applied Chemistry (common to all branches except ChE)	4	-	3	40	60	3	BS
4	CE/EE/ME 104 English for Communication	4	-	3	40	60	3	HS
5	CE/EE/ME 105 Problem Solving with C	4+1	-	3	40	60	3	ES
6	ME 106 Engineering Mechanics - I	4+1	-	3	40	60	3	ES
7	CE/EE/ME 151 Chemistry Laboratory	-	3	3	40	60	2	BS
8	CE/EE/ME 152 C-Programming Lab.	-	3	3	40	60	2	ES
9	CE/ME 153 Graphics Laboratory.	2	4	3	40	60	2	ES
Total		28	10	-	360	540	24	

B.Tech. in Mechanical Engineering

I Year (II Semester):

S.No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Semend Exam. (hrs)	Sessional Marks	Semester endExam. Marks	Credits	
1	EC/EE/ME 107 Calculus And Numerical Methods	3+1	-	3	40	60	3	BS
2	ME 108 Physics of Materials	4	-	3	40	60	3	BS
3	109 Chemistry of Engineering Materials (common to all branches except ChE)	4	-	3	40	60	3	BS
4	CE/EE/ME 110 Environmental Studies	4	-	3	40	60	3	HS
5	CE/ME 111 Engineering Drawing	2	4	3	40	60	3	ES
6	ME 112 Engineering Mechanics - II	4+1	-	3	40	60	3	ES
7	CE/EE/ME 154 Physics Laboratory	-	3	3	40	60	2	BS
8	CE/EE/ME 155 Communication Skills Lab.	-	3	3	40	60	2	HS
9	CE /ME 156 Workshop Practice	-	3	3	40	60	2	ES
Total		23	13	-	360	540	24	

B.Tech. in Mechanical Engineering

II Year I Semester):

S. No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Semester EndExam. (hrs)	Sessional Marks	Semester end Exam. Marks	Credits	
1	ME201 Complex Analysis and Numerical Solutions	3+1	-	3	40	60	3	BS
2	ME 202 Mechanics of Materials - I	4+1	-	3	40	60	3	ES
3	ME 203 Electrical Technology	4	-	3	40	60	3	ES
4	ME 204 Basic Thermodynamics	4+1	-	3	40	60	3	ES
5	ME 205 Theory of Machines and Mechanisms	4+1	-	3	40	60	3	PC
6	ME 206* **Fluid Mechanics & Hydraulic Machines**	4+1	-	3	40	60	3	PC
7	ME 251 SM & FM LAB	-	3	3	40	60	2	ES
8	ME 252 Machine Drawing & CAD LAB	-	3	3	40	60	2	PC
9	EE/ME 253 Professional Communication Skills LAB	-	3	3	40	60	2	HS
Total		28	9	-	360	540	24	

Enrollment of NCC/NSO/NSS will be initiated from the date of commencement of class work for II Year I Semester.

Subjects, which are offered in First & Second Semesters:

ME 206* : Fluid Mechanics & Hydraulic Machines

ME 212* : Basic Electronics and Mirco Controllers

B.Tech. in Mechanical Engineering

II Year II Semester):

S.No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Semester EndExam. (hrs)	Sessional Marks	Semester end Exam. Marks	Credits	
1	ME 207 Transformation Techniques and Distributions	3+1	-	3	40	60	3	BS
2	ME 208 Mechanics of Materials - II	4+1	-	3	40	60	3	ES
3	ME 209 Casting , Welding and Metal Working Process	4	-	3	40	60	3	PC
4	ME 210 Applied Thermodynamics	4+1	-	3	40	60	3	ES
5	ME 211 Engineering Metallurgy	4	-	3	40	60	3	ES
6	ME 212* **Basic Electronics and Mirco Controllers**	4	-	3	40	60	3	ES
7	ME 254 Basic Manufacturing Process LAB	-	3	3	40	60	2	PC
8	ME 255 Computer Applications in Mech. Engg. Lab	-	3	3	40	60	2	PC
9	ME 256 Basic Electrical and Electronics LAB	-	3	3	40	60	2	ES
Total		26	9	-	360	540	24	

Enrollment of Internship / Industrial Training / Certification Course will be initiated from the end of II Year II Semester.

Subjects, which are offered in First & Second Semesters:

ME 206* : Fluid Mechanics & Hydraulic Machines
ME 212* : Basic Electronics and Mirco Controllers

B.Tech. in Mechanical Engineering

III Year I Semester:

S.No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Semester EndExam. (hrs)	Sessional Marks	Semester end Exam. Marks	Credits	
1	ME 301 Professional Ethics & Human Values	4	-	3	40	60	3	HS
2	ME 302 Design of Machine Elements	4+1	-	3	40	60	3	PC
3	ME 303 Metal Cutting & Machine Tools	4	-	3	40	60	3	PC
4	ME 304 IC Engines and Gas Turbines	4+1	-	3	40	60	3	PC
5	ME 305*	4	-	3	40	60	3	PC
6	ME 306*	4+1	-	3	40	60	3	PC
7	ME 351 Machine Shop Practice	-	3	3	40	60	2	PC
8	ME 352 Fuels and IC Engines LAB	-	3	3	40	60	2	PC
9	ME 353 Modeling LAB	-	3	3	40	60	2	PC
Total		27	9	-	360	540	24	

Enrollment of MOOCS course will be initiated from the date of commencement of class work for III Year I Semester.

Subjects, which are offered in First & Second Semesters:

ME 305 : Operations Research

ME 306 : Dynamics of Machines & Vibrations

Electives	A	B	C	D
E-I: ME 311	Nano Technology	Tribology	Automobile Engineering	Industry based Elective (Introduction to Aircraft Industry and Systems)
E-II: ME 312	Measurements & Control Systems	Mechanics of Composite Materials	Refrigeration & Air-Conditioning	Industry based Elective (PLM)

B.Tech. in Mechanical Engineering

III Year II Semester:

S.No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Semester EndExam. (hrs)	Sessional Marks	Semester end Exam. Marks	Credits	
1	ME307 Manufacturing Engineering	4	-	3	40	60	3	PC
2	ME 308 Design of Transmission Elements	4+1	-	3	40	60	3	PC
3	ME 309 Heat Transfer	4+1	-	3	40	60	3	PC
4	ME 310 Finite Element Analysis	4+1	-	3	40	60	3	PC
5	ME 311* Elective-I	4	-	3	40	60	3	PE
6	ME 312* Elective-II	4	-	3	40	60	3	PE
7	ME 354 Analysis LAB	-	3	3	40	60	2	PC
8	ME 355 Heat Transfer LAB	-	3	3	40	60	2	PC
9	ME 356 Industry Based LAB	-	3	3	40	60	2	PC
Total		27	9	-	360	540	24	

- NCC/NSO/NSS Certificate must be submitted on or before the last instruction day of III Year II Semester otherwise his/her Semester End Examination result will not be declared.

Subjects, which are offered in First & Second Semesters:

ME 305 : Operations Research
ME 306 : Dynamics of Machines & Vibrations

Electives	A	B	C	D
E-I: ME 311	Nano Technology	Tribology	Automobile Engineering	Industry based Elective (Introduction to Aircraft Industry and Systems)
E-II: ME 312	Measurements & Control Systems	Mechanics of Composite Materials	Refrigeration & Air-Conditioning	Industry based Elective (PLM)

B.Tech. in Mechanical Engineering

IV Year I Semester:

S.No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Sem EndExam. (hrs)	Sessional Marks	Semester end Exam. Marks	Credits	
1	ME 401 Engineering Metrology	4	-	3	40	60	3	PC
2	ME 402 Advanced Machine Design	4+1	-	3	40	60	3	PC
3	ME 403* MOOCS	-	-	-	-	-	0	
4	ME 404 Elective-III (Open Elective)	4	-	3	40	60	3	OE
5	ME 405*	4	-	3	40	60	3	PC
6	ME 406* Elective-IV	4	-	3	40	60	3	PE
7	ME 451 Mini project / Term Paper etc.	-	3	3	100	--	2	PC
8	ME 452 Simulation LAB	--	3	3	40	60	2	PC
9	ME 453 Design and Metrology LAB	-	3	3	40	60	2	PC
Total		**21**	**9**	**--**	**380**	**480**	**21**	

* MOOCS Certificate must be submitted on or before the last instruction day of IV Year I Semester otherwise his/her Semester End Examination result will not be declared.

* Internship / Industrial Trainning / Certification Course completion certificate must be submitted on or before the last instruction day of IV Year I Semester, otherwise his / her Semester End Examination results will not be declared.

404 : Elective -III (choose from other Branches)

Branch	A	B	Branch	A	B
CE404	Basic Surveying	Building Materials and Estimation	EC404	Applied Electronics	Basic Communication
ChE404	Energy Engineering	Bio- Fuels	EE404	Non-conventional Energy Sources	Utilization of Electrical Energy
CS404	JAVA Programming	Data Base Management Systems	IT404	Software Engineering	WEB Technologies

Subjects, which are offered in First & Second Semesters:

ME 405: Operations Management

Electives	A	B	C	D
E-IV: ME 406	Mechatronics	Design for Manufacturing & Assembly	Energy Resources Utilization	Safety Management
E-V: ME 409	Flexible Manufacturing System & Group Technology	Computer Aided Design	Computational Fluid Flow and Heat Transfer	Total Quality Management
E-VI: ME 410	Robotic Engineering	Advanced Concepts in Mechanical Engineering	Solar Radiation and Energy Conversion	Industrial Administration

B.Tech. in Mechanical Engineering

IV Year II Semester:

S.No.	Code No. & Subject	Scheme of Instruction periods per week		Scheme of Examination				Category Code
		Theory + Tutorial	Practical's	Duration of Semester EndExam. (hrs)	Sessional Marks	Semester end Exam. Marks	Credits	
1	ME407 Industrial Engineering & Management	4	-	3	40	60	3	PC
2	ME 408 Automation & CAM	4	-	3	40	60	3	PC
3	ME 409* Elective-V	4	-	3	40	60	3	PE
4	ME 410* Elective-VI	4	-	3	40	60	3	PE
5	ME 454 CAM LAB	-	3	3	40	60	2	PC
6	ME 455 Project Work	-	9	3	40	60	10	PC
Total		16	12	-	240	360	24	

Subjects, which are offered in First & Second Semesters:

ME 405: Operations Management

Electives	A	B	C	D
E-IV: ME 406	Mechatronics	Design for Manufacturing & Assembly	Energy Resources Utilization	Safety Management
E-V: ME 409	Flexible Manufacturing System & Group Technology	Computer Aided Design	Computational Fluid Flow and Heat Transfer	Total Quality Management
E-VI: ME 410	Robotic Engineering	Advanced Concepts in Mechanical Engineering	Solar Radiation and Energy Conversion	Industrial Administration

R V R & J C COLLEGE OF ENGINEERING, CHOWDAVARAM, GUNTUR-19

(Autonomous)

(w.e.f. the batch of students admitted during the academic year 2016-2017)

CURRICULUM COMPONENTS

Degree Requirements for B.Tech in MECHANICAL ENGINEERING

Category of Courses	Curriculum Content (Percentage of Total No. Of Credits Program)	Subject wise Number of Contact Hours per week	Total Number of Credits
Basic Science (BS)	14.81	38	28
Engineering Science (ES)	22.75	71	43
Humanities and Social Science (HS)	6.87	18	13
Program Core (PC)	46.03	125	87
Program Elective (PE)	7.93	20	15
Open Elective (OE)	1.59	04	03
T O T A L			189

I YEAR

EC/EE/ME 101	DIFFERENTIAL EQUATIONS AND STATISTICS	L	T	P	M	C
		3	1	-	100	3

COURSE OBJECTIVES:

1. To provide knowledge on solving ordinary differential equations.
2. To provide knowledge on applications of first order ordinary differential equations.
3. To provide knowledge on solving higher order ordinary differential equations.
4. Focused in partial differential equations.
5. To provide knowledge on curve fitting, correlation and regression lines.

COURSE OUTCOMES:

On completion of this course, students will be able to:

a. Understand methods of solving first order differential equations.
b. Understand some physical applications of first order differential equations.
c. To solve higher order differential equations
d. To solve partial differential equations
e. To understand the relation between two variables by Curve fitting

UNIT I - Differential Equations of First Order **(12)**

Definition-Formation of differential equation-Equations of first order and first degree: Linear equations, Bernoulli's equation.

Exact differential equations - Equations reducible to exact equations.

UNIT II **(12)**

Applications of differential equations of first order:
Orthogonal trajectories, Newton's law of cooling, Growth and Decay Problems
Higher order Linear Differential Equations:
Definitions–Operator D–Rules for finding the complementary function.

UNIT III **(12)**

Inverse operator–Rules for finding Particular Integral–working procedure.
Method of variation of parameters
Equations reducible to linear equations with constant coefficients: Cauchy's and Legendre's Linear equations.

UNIT IV - Partial Differential Equations **(12)**

Formation-Equations solvable by direct integration-Linear equations of first order-Lagrange's linear equation.

Linear Homogeneous partial differential equations of higher order with constant coefficients.

UNIT V - Statistics **(12)**

Method of least squares - Fitting of straight line and parabola.
Correlation, Co-efficient of correlation (direct method), Lines of regression.

LEARNING RESOURCES:

TEXT BOOK:

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.

REFERENCE BOOK:

1. Advanced Engineering Mathematics by Erwin Kreyszig , John Wiley & Sons.

WEB REFERENCES:

- Newton's law of cooling: https://www.youtube.com/watch?v=y8X7AoK0-PA
- Partial Differential Equations: http://nptel.ac.in/courses/111103021/
- http://www.math.uni-leipzig.de/~miersemann/pdebook.pdf

CE/ChE/CS/IT/ EC/EE/ME 102	ENGINEERING PHYSICS	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To impart knowledge and understanding of basic principles of Ultrasound and its applications in imaging and industry
2. To understand about basic phenomena of light waves.
3. To understand about fundamentals of Laser, its types and applications. 3-D photography, principle and applications of optical fiber.
4. To understand Essential formulation of physics in the micro world.
5. To understand development of Electromagnetic wave equations.

COURSE OUTCOMES:

After completion of the course the student will be able to:

a. understand the concepts of Ultrasonic waves, production and applications in NDT.
b. understand the interference in thin films and its application, Concept of diffraction and grating, birefringence and production and detection of different polarized lights.
c. acquire Knowledge on basics of lasers, holography, fibers and their applications.
d. understand Schrodinger wave equation and its applications in 1-D with respect to the domain of quantum world.
e. describe the nature of electromagnetic radiation and matter in terms of the particles

UNIT I (12)

Ultrasonics: properties, production of ultrasonics by magnetostriction, piezo electric oscillator methods, detection by acoustic grating method, General applications of ultrasonics in industry and medicine.

NDT: Normal beam pulse echo testing, ultrasonic scanner (A & B modes)

UNIT II (12)

Physical Optics : Interference: Introduction, Stoke's principle (change of phase on reflection),

interference in thin films due to reflected light (Cosine law), theory of air wedge (fringes produced by a wedge shaped thin film), theory of Newton's rings(reflected system).

Diffraction: Introduction, Fraunhofer diffraction due to a single slit (quantitative), theory of plane transmission diffraction grating.

Polarization: Introduction, double refraction, construction and working of a nicol prism, quarter wave plate, production and detection of circular and elliptical polarizations(qualitative).

UNIT III (12)

Lasers : Characteristics, spontaneous and stimulated emissions, Einstein coefficients and relation between them, population inversion, pumping, active system, gas (He-Ne) laser, Nd: YAG laser and semiconductor (GaAs) laser, applications of lasers.

Holography: Basic principle, recording, reproduction and applications.

Fiber optics: Principle & structure of an optical fiber, numerical aperture, acceptance angle and acceptance cone, fractional index change, types of optical fibers, fiber optics in communication system and its advantages, Applications of optical fibers.

UNIT IV (12)

Principles of Quantum Mechanics : de Broglie's concept of matter waves, Davisson and Germer experiment, Heisenberg's uncertainty principle-experimental verification (electron diffraction - single slit)

Schrodinger equation and application : Time independent Schrodinger's wave equation, physical significance of the wave function, particle in a box (one dimensional), tunneling effect, expression for transition probability (Qualitative treatment).

UNIT V (12)

Electromagnetism : Induced electric fields, displacement current and conduction current, Maxwell's equation - qualitative (differential & integral forms) - significance, velocity of electromagnetic wave equation in free space, Poynting Theorem, LC oscillations (quantitative).

LEARNING RESOURCES:

TEXT BOOK(s):

1. M.N.Avadhanulu & P.G. Kshirasagar - Engineering Physics, S.Chand & Co.Ltd.
2. V. Rajendran - Engineering Physics , Tata McGraw-Hill Publishers.

REFERENCE BOOK(s):

1. Resnick & Halliday - Fundamentals of Physics, John Wiley sons.
2. SL Kakani & Shubhra kakani - Engineering Physics, 3rd Edition, CBS Publications Pvt. Ltd. Delhi.
3. B. K. Pandey & S. Chaturvedi - Engineering Physics, Cengage Learning India Pvt. Ltd., Delhi.
4. Hitendra K. Malik & A.K.Singh - Engineering Physics, TMH, New Delhi.
5. P.K.Palanisamy -Engineering Physics, Scitech Publications.

WEB REFERENCES:

- https://www.youtube.com/watch?v=UM6XKvXWVFA
- ultrasound imaging: https://www.youtube.com/watch?v=I1Bdp2tMFsY
- Fraunhofer diffraction: https://www.youtube.com/watch?v=PgW7qaOZD0U
- http://www.hlhologram.com/Basic%20Principles%20and%20Characteristics%20of%20Hologram.htm
- NPTEL Video Lectures
- Course relevant website : www.rvrjcce.ac.in/moodle/first year/engineering physics-I

CE//CS/IT/ EC/EE/ME 103	APPLIED CHEMISTRY	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To know the softening methods and quality parameters of water used in industries.
2. To know the requirements and purification methods of drinking water.
3. To understand the construction and functioning of electrochemical energy systems.
4. To study the mechanisms, types, factors influencing corrosion and protection methods of corrosion.
5. To acquire knowledge on latest analytical techniques.

COURSE OUTCOMES:

a. Students acquire knowledge on quality and utility of water in industries.
b. Students gain knowledge on water treatment for drinking purpose.
c. Able to understand functioning of electrochemical energy systems.
d. Students can relate corrosion and environment and suggest methods to prevent corrosion.
e. Can analyse substances using techniques like Spectrophotometry, Colorimetry, Conductometry and Potentiometry.

UNIT I *Text book-1* **(12)**

Water Technology: Types of Hardness- UNITs and determination by EDTA method (simple problems), Water technology for industrial purpose: Boiler troubles- scales, sludges, caustic Embrittlement, boiler corrosion, priming and foaming- causes and prevention.

Internal conditioning-phosphate, calgon and carbonate treatment. External conditioning-lime soda process (simple problems), softening by ion exchange process. Desalination of brackish water by electro dialysis and reverse osmosis.

UNIT II *Text book-1* **(12)**

Water treatment for drinking purpose- WHO guidelines ,sedimentation, coagulation, filtration (slow sand filter), various methods of chlorination, breakpoint chlorination.

Phase Rule: Statement and explanation of the terms involved, one component water system, condensed phase rule- construction of phase diagram by thermal analysis, simple eutectic system (Pb-Ag system only) ,applications eutectic compounds.

UNIT III *Text book-1* **(12)**

Electrochemistry: Electrode potential, electrochemical series and its significance, Nernst equation-derivation-related problems, Reference electrodes (SHE and Calomel electrode) Ion-selective electrode-glass electrode and measurement of pH.

Electrochemical Energy Systems: Types of electrochemical energy systems, electrochemistry of primary batteries (Lachlanche or dry cell), Secondary cells (Lead Acid cell, Ni-Cd cell), Lithium batteries (Li-MnO_2, Lithium organic electrolyte) and their advantages. Fuel cells (Oxygen-Hydrogen)

UNIT IV *Text book-1* **(12)**

Corrosion and its control: Introduction, dry corrosion, electrochemical theory of corrosion, Types of corrosion- differential aeration, galvanic (galvanic series) and Stress corrosion Factors affecting corrosion-design, pH, over voltage and temperature.
Protection methods: Cathodic protection, (Impressed current and sacrificial anode) corrosion inhibitors- types and mechanism of inhibition, metallic coatings- Galvanization, Tinning, Electroplating (Cu) and electro less plating (Ni)

UNIT V *Text book-1&2* **(12)**

Analytical Techniques: Spectroscopy- Beer-Lambert's law, UV-electronic transitions-chromophores-auxochromes-shifts, and IR- modes of vibrations, ex.H_2O, CO_2 Instrumentation of UV and IR
Colorimetry- estimation of Iron, Conductometric (HCl vs NaOH) and potentiometric titrations (Fe(II)vs $K_2Cr_2O_7$)

Learning Resources:

TEXT BOOKS

1. Engineering Chemistry, P.C. Jain and Monika Jain, 15th Edition, 2008, Dhanpat Rai Publishing Company, New Delhi.
2. A Text Book of Engineering Chemistry, Shashi Chawla, 3rd Edition, 2009, Dhanpat Rai and Co.(P) Ltd., New Delhi.

REFERENCE BOOKS:

1. A Text Book of Engineering Chemistry, S.S. Dara and S.S. Umare, 12th Edition, 2010, S.Chand and Co.Ltd.

WEB REFERENCES:

- http://www.powerstream.com/BatteryFAQ.html#lec
- http://freevideolectures.com/Course/3029/Modern-Instrumental-Methods-of-Analysis
- http://www.cdeep.iitb.ac.in/webpage_data/nptel/Core%20Science/Engineering%20Chemistry%201/

EE/ME 104	ENGLISH FOR COMMUNICATION	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

a. use vocabulary contextually.
b. compose effectively the various forms of professional communication.
c. apply grammar rules efficiently in spoken and written forms.
d. understand and overcome the barriers in communication.
e. develop professional writing.

UNIT I **(12)**

Lexis:

a. i.Synonyms & Antonyms
   ii. Words often confused.
b. i. One Word Substitutes;
   ii. Analogies

UNIT II **(12)**

Written Communication:

a. Note-taking & Note-making
b. Writing a Proposal
c. Memo Writing
d. Paragraph writing

UNIT III **(12)**

Principles of Grammar:

Exposure to basics of grammar with emphasis on

a. Articles & Prepositions
b. Tenses
c. Voice
d. Speech

UNIT IV **(12)**

Communication:

Types: Oral & Written – Barriers to communication – Non-verbal Communication - Kinesics, Proxemics, Occulesics, Haptics

UNIT V **(12)**

Composition:

a) E-mail
b) Letter-writing: order, complaint, job application, invitation.
c) Precis writing
d) Biographical writing:
   i. APJ Abdul Kalam
   ii. Ratan Tata
   iii. Sudha Murthy
   iv. Mother Teresa

TEXT BOOK:

1. Technical English - by Dr. M.Sambaiah, Wiley India Pvt. Ltd, New Delhi 2014.

REFERENCE BOOKS:

1. Dictionary of Synonyms and Antonyms, Oxford & IBH, III Ed –(UNIT-Ia), 2010.
2. Objective English III Edition, Mc-Graw Hill Companies- by Hari Mohan Prasad, Uma Rani Sharma. (UNIT Ia & b) , 2007.
3. Communication Skills – OUP, by Sanjay Kumar & Pushpa Latha (UNIT - IIa), 2015.
4. Technical Communication – Principles & Practice. II Ed, by Meenakshi Raman & Sangeetha Sharma (UNIT –II b,c,d) & (UNIT –V a,b,c) , 2015.
5. Oxford Michael Swan- Practical English Usage – III Ed . New international Students ' Ed,OUP. (UNIT- III) , 2007
6. Business Communication II Ed. Meenakshi Raman & Prakash Singh, OUP, (UNIT-IV) , 2012.
7. Handouts-(UNIT-V,(iv-a,b,c,d))
8. A course in English Communication – by Kiranmai Dutt, Rajeevan, C.L.N Prakash, 2013.
9. The Most Common Mistakes in English Usage – Thomas Elliott Berry , 2012.

WEB REFERENCES:

- https://www.youtube.com/watch?v=8dMHTg0LtkU
- https://www.youtube.com/watch?v=uuYgJN-jD9I
- http://www.famouspeoplelessons.com/r/ratan_tata.pdf

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CE/ChE/CS/IT/ EC/EE/ME 105	PROBLEM SOLVING WITH C	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

At the end of the course, the student will understand

1. The basic problem solving process using algorithm, Flow Charts and pseudo-code development.
2. The basic concepts of control structures in C.
3. The concepts of arrays, functions and pointers in C and can effectively use pointers for Dynamic memory allocation.
4. The 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.

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

UNIT I **(12)**

Introduction: Computer & it's Components, Hardware , Software, programming languages, Algorithm, Characteristics of algorithm, Flowchart, Symbols used in flowchart, history of C, structure of C program, C language features.

C Tokens: Character set, Identifiers, Keywords, constants, Data types, type qualifiers, Declaration and Initialization of variables.

Operators & Expressions: C operators and expressions, Type-conversion methods, Operators Precedence and Associativity, Input/Output functions and other library functions.

Programming Exercises: C-Expressions for algebraic expressions, Evaluation of arithmetic and boolean expressions. Values of variables at the end of execution of a program fragment, Computation of values using scientific and Engineering formulae.

UNIT II **(12)**

Control Statements: If-Else statement, Else-If statement, Switch statement and goto statement, Looping- While, Do-While and for statements, Break and continue statements.

Programming Exercises: Finding the largest of three given numbers,Computation of discount on different types of products with different ranges of discount, Finding the type of triangle formed by the given sides, Computation of income-tax, Computation of Electricity bill , Finding roots of a quadratic equation. Finding the factorial of a given number, test whether a given number is-prime, perfect, palindrome or not , Generation of prime and Fibonacci numbers.

UNIT III (14)

Arrays: One – dimensional and Two-dimensional numeric arrays, One – dimensional and Two-dimensional character arrays.

Functions: Function Definition, Function prototype, types of User Defined Functions, Function calling mechanisms, Built-in string handling and character handling functions, recursion, Storage Classes, multi-file compilation, Function with Arrays.

Programming Exercises: Computation of statistical parameters of a list of numbers, sorting and searching a given list of numbers, Operations on Matrices such as addition, multiplication, Transpose of a matrix. Finding whether a given string is palindrome or not, sorting of names, operations on strings with and without using library functions, recursive functions to find the factorial value, Fibonacci series, GCD, swapping of two variables, calling the function by passing arrays.

UNIT IV (12)

Pointers: Pointer, Accessing a variable through pointer, pointer Arithmetic, pointer and Arrays, Dynamic memory allocation, pointer to pointer, Array of pointers.

Structures: Structures, Nested structures, Array of structures, Pointer to structures, passing structures to functions, self referential structure, Unions.

Programming Exercises: Sort and search the given list using functions and pointers, operations on arrays using functions and pointers. Operations on complex numbers, maintaining the books details by passing array of structures to functions, sorting the list of records.

UNIT V (10)

Files: defining and opening a file, closing a file, input/output operations on files using file handling functions, random access to files.

Command line arguments, C-preprocessor directives.

Programming Exercises: create and display the contents of text file, copy the contents of one file into another, merging the contents of two files, writing, reading and updation of student records in a file, programs to display the contents of a file and copy the contents of one file into another using command line arguments.

TEXT BOOKS:

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,Pearson
2. C- Complete Reference, Herbert Sheildt, TMH., 2000
3. Programming with C by K R Venugopal & Sudeep R Prasad, TMH., 1997
4. The C programming language by Brian W.Kernighan & Dennis M.Ritchie, Second Edition, Prentice Hall

WEB REFERENCES:

http://cprogramminglanguage.net/
http://lectures-c.blogspot.com/
http://www.coronadoenterprises.com/tutorials/c/c_intro.htm
http://vfu.bg/en/e-Learning/Computer-Basics--computer_basics2.pdf

ME 106	ENGINEERING MECHANICS - I	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

1. Learn and understanding the basic principles of mechanics of rigid bodies, various types of force systems and to analyze problems in a simple and logical manner.
2. Study and Calculate the unknown forces through the use of equilibrium equations for a rigid body and to analyze simple trusses using method of joints and method of sections
3. Study the force systems in space using vector algebra and carry out static force analysis of rigid bodies and simple machines like wedges in dry frictional contact.
4. Study and determine centroids and centre of gravity of various standard geometrical shapes as well as composite areas and bodies.
5. Learn the principle of virtual work and the concept of moment of inertia and the mathematical calculations involved in finding moments of inertia of two dimensional areas.

COURSE OUTCOMES:

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

a. Apply the principles of mechanics to determine the resultant of several concurrent forces acting on a particle.
b. Apply the equilibrium equations to determine unknown forces and moments acting on a rigid body and also analyse the trusses using method of joints and method of sections
c. Analyse the force system in space using vector notation and apply the basic concepts of dry friction on inclined planes and wedges.
d. Determine the centriods and center of gravity of mathematically definable areas as well as composite areas of standard geometrical shapes.
e. Apply principle of virtual work for equilibrium of ideal systems and calculate the moment of inertia of various shapes by integration and moment of inertia of composite areas.

UNIT I (12)

Concurrent Forces in a Plane:
Principles of statics, Force, Addition of two forces: Parallelogram Law, Composition and resolution of forces, Constraint, Action and Reaction, Types of supports and support reactions, Free body diagram. Equilibrium of concurrent forces in a plane – Method of projections, Method of moments.

UNIT II (12)

Parallel Forces in a Plane: Types of parallel forces, Couple, resolution of a force into a force and a couple, general case of parallel forces in a plane.

General Case of Forces in a Plane: Composition of forces in a plane, Equilibrium of forces in a plane, plane trusses-methods of joints and method of sections,

UNIT III (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.
Friction: Introduction, the laws of friction, coefficient of friction, angle of friction, problems involving dry friction, wedges.

UNIT IV (12)

Centroid and Centre of Gravity: Concept of centroid and centre of gravity, Centroid of areas and lines, Centroids of simple areas from basic principles, Centroid of composite plane areas and curves. Centre of gravity of three dimensional bodies: right circular cone, hemisphere, theorems of Pappus-Guldinus.

UNIT-V (12)

Virtual Work: Introduction, principle of virtual work, Equilibrium of Ideal systems
Moments of Inertia of Plane Figures: Introduction, Moment of inertia of a plane area with respect to an axis in its plane, polar moment of inertia, Parallel axis theorem, moment of inertia of standard sections by integration, Moment of inertia of composite areas.

LEARNING RESOURCES

TEXT BOOKS:

1. Engineering mechanics by S. Timoshenko, D. H. Young and J V Rao –Tata McGraw-Hill Publishing Company Limited, New Delhi(For concepts) , 2009.
2. Engineering mechanics by Basudeb Bhattacharyya, Second Edition, Oxford University Press, 2014. *(For numerical problems)*
3. Engineering mechanics-statics and dynamics by A. K. Tayal – Umesh publications, Delhi, 2008. *(For numerical problems)*

REFERENCE BOOKS:

1. Engineering Mechanics by S.S.Bhavikatti, 4th edition, New Age international Publishers.
2. Singer's Engineering Mechanics: Statics and Dynamics, K.Vijaya Kumar Reddy and Suresh Kumar, 3rd Edition SI UNITs - BSP Books Pvt.Ltd. Publications.
3. A textbook of Engineering mechanics statics and dynamics by J. L. Meriam and L.Kraige, 7th Edition.

WEB RESOURCES

- http://nptel.iitm.ac.in/
- www.learnerstv.com/Free-Engineering-video-lecture-courses.htm
- http://en.wikibooks.org/wiki/Statics

CE/EE/ME 151	CHEMISTRY LABORATORY	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

1. To learn the concepts of equivalent weight, molecular weight, normality, molarity, weight percent, volume percent.
2. To prepare molar solutions of different compounds.
3. To know the methods of determining alkalinity, hardness and chloride ion content of water sample.
4. To know the methods to determining purity of washing soda, percentage of available chlorine in bleaching powder.
5. To learn the redox methods to determine Fe2+ ions present in solution.
6. To know principles and methods involved in using instruments like conductivity bridge, spectrophotometer, pH meter and potentiometer

COURSE OUTCOMES:

a. Students acquire knowledge on normality, molarity, molecular weight, equivalent weight, oxidizing agent, reducing agent.
b. Students can prepare solutions with different concentrations.
c. Students can analyze water for its hardness, alkalinity, chloride ion content, iron content.
d. Students understand the principles behind the development of instruments suitable for chemical analysis. Later he can use the knowledge in modifying instruments.

Any 10 out of the following experiments

1. Determination of total alkalinity of water sample
    a. Standardization of HCl solution
    b. Determination of alkalinity of water
2. Determination of purity of washing soda
    a. Standardization of HCl solution
    b. Determination of percentage purity of washing soda
3. Estimation of Chlorides in water sample
    a. Standardization of $AgNO_3$ solution
    b. Estimation of Chlorides in water
4. Determination of Total Hardness of water sample
    a. Standardization of EDTA solution
    b. Determination of Total Hardness of water
5. Estimation of Mohr's salt-Permanganometry
    a. Standardization of $KMnO_4$ solution
    b. Estimation of Mohr's salt
6. Estimation of Mohr's salt -Dichrometry
    a. Standardization of $K_2Cr_2O_7$ solution
    b. Estimation of Mohr's salt

7. Determination of available chlorine in bleaching powder-Iodometry
    a. Standardization of Hypo
    b. Determination of available chlorine in bleaching powder
8. Estimation of Magnesium
    a. Standardization of EDTA solution
    b. Estimation of Magnesium
9. Conductometric titration of an acid vs base
10. Potentiometric titrations: Ferrous Salt vs Dichromate

Demonstration Experiments:

11. pH metric titrations of an acid vs base
12. Spectrophotometry: Estimation of Mn/Fe

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

CE/EE/ME 152	C-PROGRAMMING LAB	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

1. Understand the ANSI C/Turbo C compilers.
2. Be able to develop various menu driven programs using conditional and control flow statements.
3. Develop programs using structures, unions and files.
4. Develop 'C' programs for various applications.
5. Be able to participate and succeed in competitive examinations.

COURSE OUTCOMES:

a. The ability to develop various menu driven programs like generation of electricity bill, evaluation of series etc.
b. The practical knowledge to write C programs using 1D, 2D and Multi-Dimensional arrays.
c. Able to write C programs to develop various applications using structures, unions and Files.
d. Thorough practical knowledge to develop 'C' programs for various applications.

List of programs (to be recorded)

LAB CYCLE:

1. A program for electricity bill taking different categories of users, different slabs in each category. (Using nested if else statement or Switch statement).

Domestic level consumption as follows	
Consumption UNITs	Rate of charges(Rs.)
0-200	0.50 per UNIT
201-400	100 plus 0.65 per UNIT
401-600	230 plus 0.80 per UNIT
601 and above	390 plus 1.00 per UNIT
Street level consumption as follows	
Consumption UNITs	Rate of charges(Rs.)
0-100	0.50 per UNIT
101-200	50 plus 0.60 per UNIT
201-300	100 plus 0.70 per UNIT
301 and above	200 plus 1.00 per UNIT

2. Write a C program to evaluate the following (using loops):
   (i) $x-x^3/3!+x^5/5!-x^7/7!+$----------up to n terms
   (ii) $1+x+x^2/2!+x^3/3!+$----------up to n terms
   (iii) $1-x^2/2!+x^4/4!-x^6/6!+$----------up to n terms

3. A menu driven program to test whether a given number is (using Loops):
   (i) Prime or not
   (ii) Perfect or not
   (iii) Armstrong or not
   (iv) Strong or not
   (v) Palindrome or not

4. A menu driven program to display statistical parameters (using one - dimensional array)
   (i) Mean
   (ii) Median
   (iii) Mode
   (iv) Standard deviation

5. A menu driven program to perform the following operations in a list (using one - Dimensional array)
   (i) Insertion of an element
   (ii) Deletion of an element
   (iii) Remove duplicates form the list
   (iv) Print the list

6. A menu driven program with options (using two dimensional array)
   (i) To compute A+B
   (ii) To compute A x B
   (iii) To find transpose of matrix A.
   Where A and B are matrices.

7. Write C programs to perform the following using Strings
   (i) To test the given string is palindrome or not
   (ii) To sort strings in alphabetical order

8. Write C programs using recursive functions
   i) To find the Factorial value
   ii) To generate Fibonacci series
   iii) To find the GCD of two given numbers

9. A menu driven program with options (using dynamic memory allocation)
   (i) Linear search
   (ii) Binary search

10. A menu driven program with options (using Character array of pointers)
   (i) To insert a student name
   (ii) To delete a name
   (iii) To sort names in alphabetical order
   (iv) To print list of names

11. Write a program to perform the following operations on Complex numbers (using Structures & pointers):

i) Read a Complex number
ii) Addition, subtraction and multiplication of two complex numbers
iii) Display a Complex number

12. Write C programs to perform the following operations on files

i) merging the contents of two files
ii) writing, reading and updating student records in a file
iii) Copy the contents of one file into another using command line arguments

ME/CE 153	GRAPHICS LAB	L	T	P	M	C
		2	-	4	100	2

COURSE OBJECTIVES:

1. To study and know the use of instruments applicable to Engineering Drawing.
2. To impart knowledge on shop floor dimensioning, lettering and line types.
3. To understand the fundamentals of geometry like scales and Engineering curves.
4. To make the students learn different methods in constructing conics and curves.
5. To study different types of projections and to impart knowledge on projecting one & two dimensional figures and to visualize the different positions of planes.

COURSE OUTCOMES:

On completion of the course , students will

a. Acquire basic skills in technical graphic communication and also get thorough knowledge of various geometrical elements used in Engineering practice.
b. Be able to use the instruments required for Drawing.
c. Be able to dimension, print letters which can be understood globally.
d. Gather good knowledge in various kinds of scales and their practical usage.
e. Understand the Projections of points, lines and planes and their representation and dimensioning.

General: Use of drawing instruments, Lettering, Single stroke letters, Dimensioning-Representation of various type lines. Geometrical Constructions.

Conics and Curves: General construction, Oblong and Concentric circle, methods for Ellipse, Tangent and Rectangular methods for Parabola. Cycloidal curves - Cycloid, Eepicycloid and Hypocycloid; involute of circle, Spirals

Scales: Types of scales, Representative Fraction, Construction of Plain, Diagonal and Vernier Scales.

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

Projections of Planes: Projections of planes, projections on auxiliary planes.

TEXT BOOK:

1. Engineering Drawing by N.D. Bhatt & V.M. Panchal. 52nd Edition, Charotar Publishing House Pvt. Ltd., 2014.
2. Engineering Drawing by N.S. Pardthasarathy & Vela Murali, Oxford University Press, 2015.

REFERENCE BOOK:

1. Engineering Drawing by Prof.K.L.Narayana & Prof. R.K.Kannaiah., 2nd Edition, Scitech Publications.

WEB RESOURCES

- https://www.youtube.com/watch?v=HnjWHta89g0
- https://www.youtube.com/watch?v=1AMyZ-WzPB0
- https://www.youtube.com/watch?v=j6zPhf3d8uo
- https://www.youtube.com/watch?v=K-NceraNnS0

EC/EE/ME 107	CALCULUS AND NUMERICAL METHODS	L	T	P	M	C
		3	1	-	100	3

COURSE OBJECTIVES:

1. Finding the Eigen values and Eigen vectors and inverse of a matrix and getting familiarity with diagonalization and quadratic forms.
2. To give basic knowledge on evaluation of double, triple integrals, area and volume.
3. To provide sufficient theoretical and analytical background of differentiation and integration of vector functions.
4. To provide basic knowledge of numerical methods including solving systems of linear equations.
5. To provide knowledge on numerical differentiation and integration.

COURSE OUTCOMES:

On completion of this course, students will be able to:

a. Understand the basic linear algebraic concepts.
b. Evaluate double, triple integrals and the area, volume by double & triple integrals respectively.
c. Solve gradient, divergence, curl and integration of vector function problems.
d. Solve system of equations.
e. Evaluate derivatives and integrals using numerical techniques.

UNIT I - Matrices (12)

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values (without proofs) – Cayley – Hamilton theorem (without proof).
Reduction to diagonal form. Reduction of quadratic form to canonical form by orthogonal transformations, Nature of a quadratic form.

UNIT II - Multiple Integrals (12)

Double integration in Cartesian and polar coordinates – Change of order of integration – Area as a double integral.
Triple integration in Cartesian coordinates – Change of variables in double integrals from Cartesian to polar – Volume as a Triple Integral.

UNIT III - Vector Calculus (12)

Gradient, Directional derivatives, divergence, curl – Solenoidal and irrotational fields – Vector identities (without proof).
Line, surface and volume integrals – Green's theorem in the plane, Stoke's theorem and Gauss divergence theorem (without proofs).

UNIT IV - Numerical Solution of Equations and Interpolation (12)

Newton - Raphson method – Gauss Seidel method. Forward and backward differences – Differences of a polynomial.

Interpolation – Newton-Gregory Forward and Backward Interpolation formulae (without proof), Lagrange's Interpolation formula (without proof) – Inverse interpolation.

UNIT V – Numerical differentiation and Integration (12)

Newton's forward and backward differences formulae to compute first and second order derivatives.

Trapezoidal rule – Simpson's one third rule.

LEARNING RESOURCES:

TEXT BOOK:

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.

REFERENCE BOOK:

1. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons.

WEB RESOURCES

- https://www.math.ubc.ca/~anstee/math104/104newtonmethod.pdf
- https://www.youtube.com/watch?v=brBSk1rthtg
- http://tutorial.math.lamar.edu/Classes/CalcIII/DIPolarCoords.aspx

ChE/CE/ME 108	PHYSICS OF MATERIALS	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Significance of Miller indices in crystal structures and Characterization by X-rays, study of crystal defects
2. Learning about basics of ceramics and Composite materials
3. Introduction to Bio materials and Shape memory alloys
4. Basics of Dielectrics and magnetism, Classification of materials on Polarization and Magnetization and applications.
5. Properties and applications of super conducting and nano materials.

COURSE OUTCOMES:

a. X-ray Characterizing the crystals and effects of defects on properties of the solid
b. Acquire Knowledge on Ceramics and Composites
c. Significance of Bio and Shape memory alloys in present day technology
d. Importance of polarization and magnetization phenomena and their applications
e. Relevance of superconductivity and nano materials.

Unit I (12)

X-ray diffraction techniques: Direction in crystals, planes in crystals-Miller indices, separation between successive (h, k, l) planes, diffraction of x-rays by crystal planes-Derivation of Bragg's law, determination of lattice parameters- by Bragg's x-ray Spectrometer.

Crystal defects: Classification of crystal defects, point defects (Lattice vacancy ,Schottky, Frenkel and impurity atoms) line defects(Edge and Screw) , Burger's vector. (qualitative treatment- no derivations).

Unit II (12)

Composite Materials: Classification, Large particle reinforced and dispersion strengthened composites; Fiber orientation and concentration influences, discontinues and alignment randomly oriented; Processing techniques for composites: wet hand lay up, filament winding & pre-preg methods, applications.

Advanced ceramics: Classification, glass, traditional & modern ceramics ; structure, non crystalline & crystalline compounds with NaCl fluriote & Pervoskite structures. Fabrication: casting, wet bag isotatic pressing, Ceramic fibers, density, thermal and mechanical properties in brief. applications of ceramics.

Unit III (12)

Bio-materials and Shape memory alloys: Bio inert, Bioactive, Biodegradable materials, Classification: Metals and alloys, polymers, hydro gels, composites and ceramic bio materials. Applications.

Origin and principle of Phase transformation in Shape memory alloys(SMA) . SMA properties- hysteresis, pseudo-elastic effect and thermo elasticity. commercial SMA's in brief – NiTi ,Cu, Iron based alloys. applications of SMA.

Unit IV (12)

Magnetic Materials: Introduction, origin of magnetic moment and Bohr magneton, classification of dia, para and ferro magnetic materials on the basis of magnetic moment (Qualitative), soft and hard magnetic materials, Ferrites and their applications.

Dielectric Materials: Fundamental definitions: Electric dipole moment, polarization vector, polarizability, electric displacement, dielectric constant and electric susceptibility. Types of polarizations - Electric and ionic polarizations, internal fields in solids (Lorentz method), Clausius-Mossotti equation, Frequency dependence of polarization, Ferroelectrics and their applications.

Unit V (12)

Superconducting materials: Introduction, critical parameters (Tc, Hc, Ic), Meissner effect, types of superconductors, entropy, specific heat, energy gap, BCS Theory(in brief), applications of superconductors.

Nanomaterials : Basic Concepts of science & technology, nano scale, introduction to nano materials, surface to volume ratio, General properties of nano materials in brief, fabrication of nano materials (sol-gel and chemical vapour deposition methods), applications of nano materials.

Text Books :

1. Material Science V. Rajendran - MGH Unit I,Unit II, Unit IV and Unit V
2. Engineering Physics - M. Arumugam, Anuradha Publications, Chennai. Unit III

Reference Books:

1. Materials science – M. Vijaya and G. Rangarajan, TMH, New Delhi
2. Solid state physics by A. J. Dekkar.

WEB RESOURCES

- http://www.authorstream.com/Presentation/mk.anuja-1817353-ray-diffraction-methods
- http://www.explainthatstuff.com/composites.html
- http://www.slideshare.net/mayabhat1/nanomaterials-16801288
- http://faculty.uml.edu/zgu/Teaching/documents/Lecture6Synthesis_000.pdf

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CE/CSE/ECE/ EEE/IT/ME 109	CHEMISTRY OF ENGINEERING MATERIALS	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To acquire knowledge on formation of polymers and conditions to act as conducting polymers.
2. To gain knowledge on the chemistry of some important plastics and rubbers commonly used.
3. To understand parameters related to efficiency of various fuels.
4. To gain knowledge on the characteristics of refractories and lubricants.
5. To understand the requirements and chemistry of explosives and utility of liquid crystals.

COURSE OUTCOMES:

a. Students know the formation of polymers and the utility of conducting polymers in electronics, electrical and other fields.
b. Students would be able to know usage of plastics and elastomers in day-to-day life and in fields like automobile, electronics, etc.
c. Would acquire knowledge on composition, quality and uses of various fuels.
d. Would be capable of selecting appropriate lubricant for a given system, and know the characteristics and utility of refractories.
e. Students acquire knowledge on the requirements, applications of liquid crystals and explosives.

UNIT II *Textbook-1 & 2* **(12)**

Polymers:

Monomer functionality, degree of polymerization, Tacticity, classification of polymerization- addition, condensation and co-polymerization, mechanism of free radical polymerization.

Conducting polymers: Introduction, examples and applications, Polyacetylene-mechanism of conduction.

UNIT II *Textbook-1* **(12)**

Plastics- Thermoplastic and thermosetting resins, preparation, properties and uses of Bakelite, polyesters, Teflon and PVC. Compounding of plastics.

Rubber- Processing of latex, Drawbacks of natural rubber- Vulcanization, Chemistry of Synthetic rubbers- Buna-S and Buna-N, polyurethane rubber and silicone rubber, epoxy resin (adhesive)

UNIT III *Textbook-1* **(12)**

Fuels: Classification of fuels, calorific value- LCV and HCV-UNITs and determination by Bomb calorimeter, Coal- Ranking, proximate and ultimate analysis, carbonization of coal-types (using Beehive oven), Metallurgical coke-properties and uses.

Petroleum based**:** Fractional distillation, cracking-fixed bed, reforming, octane number and cetane number of liquid fuels, composition and uses of petrol, diesel**,** CNG and LPG.

UNIT IV *Textbook-1&2* **(12)**

Refractories: Characteristics, classification, properties and their significance– refractoriness, strength of refractoriness under load, dimensional stability, thermal spalling, thermal expansion, thermal conductivity, porosity Common refractory bricks- silica, fire clay and carborundum.

Lubricants: Classification, functions, properties of lubricants- Viscosity, Viscosity index, Flash point, Fire point, Cloud point, Pour point, Oilyness. Solid lubricants –Graphite and Molybdenum sulphide, Additives, determination of viscosity by Red wood viscometer

UNIT V *Textbook-1* **(12)**

Liquid crystals: Structure of liquid crystal forming compounds, Classification and applications.

Explosives: Characteristics, terms related to explosives, classification-primary, low and high explosives. Manufacture of gun powder, lead azide, nitroglycerine and RDX.

Learning Resources:

TEXT BOOKS:

1. Engineering Chemistry, P.C. Jain and Monika Jain, 15th Edition, 2008, Dhanpat Rai Publishing Company, New Delhi.
2. A Text Book of Engineering Chemistry, Shashi Chawla, 3rd Edition, 2009, Dhanpat Rai and Co. (P) Ltd., New Delhi.

REFERENCE BOOKS:

1. A Text Book of Engineering Chemistry, S.S. Dara and S.S. Umare, 12th Edition, 2010, S.Chand and Co.Ltd.
2. Principles of Polymer Science, P.Bahadur and N.V. Sastry, Narora Publishing House

WEB REFERENCES:

- http://www.chem1.com/acad/webtext/states/polymers.html
- http://www.nptel.ac.in/courses/104105039/
- http://freevideolectures.com/Course/3070/Science-and-Technology-of-Polymers

CE/ChE/CSE/ECE/ EEE/IT/ME 110	ENVIRONMENTAL STUDIES	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To give a comprehensive insight into natural resources, ecosystems and bio diversity.
2. To create an awareness on various aspects of environmental pollution and effects.
3. To educate the ways and means to protect the environment from pollution.
4. To impart fundamental knowledge on human welfare and environmental acts.
5. To demonstrate the environmental problems like global warming, ozone layer depletion, acid rains.

COURSE OUTCOMES:

a. To define and explain the basic issues concerning the ability of the human community to interact in a sustainable way with the environment.
b. To describe and discuss the environmental implications of biologically important materials through the ecosystems.
c. To describe and discuss the environmental pollution implications and watershed management
d. To discuss the benefits of sustaining each of the following resources - food, health, habitats, energy, water, air, soil and minerals.
e. To understand the causes, effects and controlling measures of different types of environmental pollutions with some case studies.

UNIT I (12)

Introduction
Definition, Multidisciplinary nature, Scope and Importance of environmental studies.

Natural Resources
Forest Resources: Use and over-exploitation, Deforestation, Effects of Mining and Big dams on forests and tribal people. Water Resources: Use and over-utilization of surface and groundwater, floods and droughts, Water logging and salinity; Conflicts over water. Energy resources: Renewable and non-renewable Energy sources; Land as a resource, land degradation, Soil erosion & Desertification.

UNIT II (12)

Ecosystems
Definition, Structure and functions of Ecosystems, a general account of types of ecosystems with examples. Bio-geo chemical cycles (water, carbon, and nitrogen).

Biodiversity and its Conservation

Definition of Biodiversity, Values and threats to biodiversity and conservation of biodiversity. Bio-geographical classification of India, India as a mega-diversity nation, Hot-spots of biodiversity, IUCN classification of Biodiversity; Endemic, Exotic and Endangered species – Meaning with a few examples from India.

UNIT III (12)

Environmental Pollution

Causes, effects and control measures of Air pollution including Noise, Fresh Water pollution, Marine pollution, Thermal pollution, and nuclear pollution. Solid wastes – Types based on source (Ex. Municipal, Industrial, Constructional and Medical) and nature (degradable and non-degradable); Effects of improper dumping. Solid waste management – Objectives, practices.

Water shed and its management

Definition and importance; Water shed management methods including rain water harvestment.

UNIT IV (12)

Social Issues and Environment

Definition of sustainable development, key types and measures for sustainable development; salient features of Stockholm conference 1972, Earth summit, 1992; Human Population and environment, Green revolution, Resettlement and rehabilitation of people - problems and concerns.

Climate Changes

Green House Gases, Kyoto Protocol, Global warming (The story of Tuvalu); Ozone depletion and Acid rain; Environmental Impact Assessment.

UNIT V (12)

Environmental acts

Environmental Legislation; Wild life protection act, 1972; Water(Prevention and Control of pollution) act, 1974; Forest Conservation act, 1980; Air (Prevention and Control of pollution) act, 1981; Environmental protection act, 1986.

Case Studies

Chipko movement, Narmada Bachao Andolan, Silent Valley Project, Chernobyl Nuclear Disaster, Bhopal Tragedy, Ralegaon Siddhi, The story of Ganga.

Field work

Visit to a local area to document environmental assets - river/ forest/grassland / hill / mountain.

Study of local environment-common plants, insects, birds.

Study of simple ecosystems - pond, river, hill, slopes etc.

Visits to industries, water treatment plants, and effluent treatment plants.

LEARNING RESOURCES

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Environmental Studies by T Benny Joseph,, the Tata McGraw-Hill Publishing Company Limited, New Delhi., 3rd print, 2006.
2. Environmental Science by G. Tyler Miller Jr. CENGAGE Learning, New Delhi, 3rd edition, 2011.

WEB REFERENCES:

- http://www.slideshare.net/mshanmugaraj1/environmental-pollution-causes-effects-and-control-measures
- http://www.who.int/water_sanitation_health/resourcesquality/wpccasestudy1.pdf
- http://www.slideshare.net/pjoon007/bhopal-gas-tragedy-case-study

CE/ME 111	ENGINEERING DRAWING	L	T	P	M	C
		4	-	4	100	3

COURSE OBJECTIVES:

1. Comprehend general projection theory with emphasis on orthographic projection to represent three dimensional objects in two dimensional views.
2. To visualize the different positions of solids and to be able to plan and prepare neat orthographic drawings of solids.
3. To evident the features when solids are cut into sections, to draw and identify various types of section views.
4. To enable the students learn various aspects of development of surfaces used in sheet metal working along with a thorough knowledge in interpenetration of solids.
5. To know various isometric and orthographic views and their applications in the daily life.

COURSE OUTCOMES:

On completion of the course the students will

a. Be able to visualize and communicate with two dimensional as well as three dimensional shapes.
b. Understand the application of industry standards and best practices applied in Engineering drawing.
c. Be able to apply the knowledge of development of surfaces in real life situations.
d. Get insight into the concepts of projection, representation and dimensioning of three dimensional objects like Prisms, Cylinders, Pyramids, Cones.
e. Thoroughly understand the concept of isometric & orthographic projections which will be useful for the visualization of any object. This subject also paves the way for learning Auto Cad, CAD / CAM, CATIA and Pro E which are advanced software packages needed for every mechanical engineer.

UNIT I **(12)**

Projections of Solids: Projections of Cubes, Prisms, Pyramids, Cylinders and Cones with varying positions.

UNIT II **(12)**

Sections of Solids: Sections of Cubes, Prisms, Pyramids, cylinders and Cones.true shapes of sections. (Limited to the section planes perpendicular to one of the principal planes).

UNIT III (12)

Development of Surfaces: Lateral development of cut sections of Cubes, Prisms, Pyramids, Cylinders and Cones.

UNIT IV (12)

Interpenetration of Solids : Interpenetration of Prism in prism, (Treatment is limited to triangular & square prisms) and Cylinder in Cylinder with their axes perpendicular without offsets.
Isometric Views : Conversion of Orthographic Projections into isometric views. (Treatment is limited to simple objects only).

UNIT V (12)

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

TEXT BOOK:

1. Engineering Drawing by N.D. Bhatt & V.M. Panchal. 52nd Edition, Charotar Publishing House Pvt. Ltd., 2014.
2. Engineering Drawing by N.S. Pardthasarathy & Vela Murali, Oxford University Press, 2015.

REFERENCE BOOKS:

1. Engineering Drawing by Prof.K.L.Narayana & Prof. R.K.Kannaiah, 2nd Edition, Scitech Publications.

WEB REFERENCES:

- https://www.youtube.com/watch?v=QHogS8XvfQk
- https://www.youtube.com/watch?v=OSISqnclmWA
- https://www.youtube.com/watch?v=1ABlR5ePOLQ
- https://www.youtube.com/watch?v=_-5jusYvdiU
- https://www.youtube.com/watch?v=p7Tz17AfzE&list=PLEaGhecvxyPcIhz_ub12aiQe5GPbNrLN_
- https://www.youtube.com/watch?v=NxDwDK0ivJQ

ME 112	ENGINEERING MECHANICS - II	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

1. Develop an understanding of rectilinear and curvilinear translation of a particle.
2. Learn principle of dynamics and apply it to impulse and momentum, work and energy which is useful to analyze turbo machineries.
3. Study the principle of conservation of energy and direct central impact.
4. Develop an understanding of kinematics of Curvilinear motion of a particle.
5. Study the concept of mass moment of inertia and the mathematical calculations involved in finding moments of inertia of material bodies.
6. Study and analyze the kinematics of rotation of a rigid body about a fixed axis.
7. Learn the concept of relative velocity, instantaneous centre and dynamic equilibrium of rolling bodies in plane motion.
8. Learn the concept of simple harmonic motion, basics of mechanical vibrations.

COURSE OUTCOMES:

a. Determine velocity and acceleration of a particle under rectilinear and curvilinear translation
b. Apply dynamic Equilibrium Equation for rigid bodies under rectilinear and curvilinear translation in the fields of Railways, Ships, guns, automobiles, Aircrafts, guns, rockets etc.,
c. Determine the mass moments of inertia and radius of gyration of mathematically definable material bodies of standard shapes.
d. Understand kinematics and kinetics of rotation of a rigid body about a fixed axis.
e. Understand the concept of relative velocity, instantaneous centre and dynamic equilibrium of rolling bodies in plane motion.
f. Determine velocity and acceleration of a particle under simple harmonic motion, understand the mechanical vibrations related terms.

UNIT I **(12)**

Kinematics of Rectilinear Motion: Introduction to dynamics, displacement, velocity and acceleration, motion with uniform and variable acceleration.

Kinetics of Rectilinear Motion: Equation of rectilinear motion – motion of a particle acted upon by a constant force - D'Alemberts principle, work and energy, impulse momentum, conservation of energy, collision of elastic bodies-direct central impact

UNIT II **(12)**

Kinematics of Curvilinear Motion: Introduction, components of motion- rectangular components - normal and tangential components.
Kinetics of Curvilinear Motion: Equations of motion-rectangular components-tangential and normal components, Equations of dynamic equilibrium - D'Alembert's principle, Work and Energy.

UNIT III **(12)**
Moment of Inertia of Material Bodies: Moment of inertia of a rigid body,Moment of inertia of laminas , Moment of inertia of three dimensional bodies- solid right circular cone, solid cylinder, sphere & parallelepiped.
Rotation of a rigid body about a fixed axis:
Kinematics of rotation, Equation of motion for a rigid body rotating about a fixed axis, Rotating under the action of constant moment.

UNIT IV **(12)**
Kinematics of plane motion: Concepts of relative velocity and instantaneous center.
Kinetics of plane motion: Equations of motion, Dynamic equilibrium of symmetrical rolling bodies.

UNIT V **(12)**
Simple Harmonic Motion: Introduction - velocity and acceleration of a particle moving with SHM - SHM related terms - oscillation of a vertical elastic string or spring –stiffness of the spring-.
Mechanical Vibrations: Introduction-classification of vibration-damping and vibration-features of vibrating system, springs in series ,springs in parallel and equivalent spring constant ,free vibration without damping.

TEXT BOOKS:
1. Engineering mechanics by S. Timoshenko, D. H. Young and J V Rao –Tata McGraw-Hill Publishing Company Limited, New Delhi(For concepts) , 2009.
2. Engineering mechanics by Basudeb Bhattacharyya, Second Edition, Oxford University Press, 2014. *(For numerical problems)*
3. Engineering mechanics-statics and dynamics by A. K. Tayal – Umesh publications, Delhi, 2008. *(For numerical problems)*

REFERENCE BOOKS:
1. Engineering Mechanics by S.S.Bhavikatti, New Age international Publishers , 2012
2. Engineering Mechanics- Statics and Dynamics by Irving H. Shames, Pearson , Education , 2006
3. Singer's Engineering Mechanics: Statics and Dynamics, K.Vijaya Kumar Reddy and J Suresh Kumar, 3rd Edition SI UNITs-BS Publications , 2010.
4. A Textbook of Engineering mechanics statics and dynamics by J. L. Meriam, and L.Kraige, Wiley India, 6th Edition, 2010.

WEB REFERENCES:
- https://www.youtube.com/watch?v=ZwuwzE1qAi4
- http://kestrel.nmt.edu/~raymond/classes/ph321/notes/dalembert/dalembert.pdf

CE/EE/ME 154	PHYSICS LABORATORY	L	T	P	M	C
		-	-	3	100	2

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:

a. Use CRO, signal generator, spectrometer for making measurements.
b. Test the optical components using principles of interference & diffraction.
c. Determination of the selectivity parameter in electrical circuits.

(Any 10 out of the following experiments)

1. Interference fringes – measurement of thickness of a foil using wedge method.
2. Newton's rings - measurement of radius of curvature of Plano- convex lens.
3. Lissajous' figures – calibration of an audio oscillator.
4. Photo cell – characteristic curves and determination of stopping potential.
5. Diffraction grating - measurement of wavelengths.
6. Torsional pendulum – determination of Rigidity modulus of a wire.
7. Photo-Voltaic cell – determination of fill factor.
8. Series LCR resonance circuit –determination of Q factor.
9. Sonometer – determination of A.C. frequency.
10. Laser- determination of wave length using diffraction grating.
11. Variation of magnetic field along the axis of a circular current carrying coil.
12. Optical Fiber – Determination of Numerical Aperture and Acceptance Angle.

Reference Book: Lab Manual by R.V.R. & J.C. College of Engg. , Guntur.

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

CE/EE/ME 155	COMMUNICATION SKILLS LAB	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

1. To acquaint the students with the standard English pronunciation, i.e., Received Pronunciation(RP),with the knowledge of stress and intonation.
2. To develop the art of effective reading and answer comprehension passages.
3. To enable the students use phrasal verbs and idiomatic expressions in an apt manner.
4. To equip with appropriate and spontaneous speech dynamics.
5. To develop production and process of language useful for social and professional life.

COURSE OUTCOMES:

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

a. Know the IPA phonetics symbols, and their relation to pronunciation; recognize the difference among the native, regional and neutral accent of English.
b. Employ different skills, inferring lexical and contextual meaning and attempt comprehension passages.
c. Use confidently phrases and idioms for effective communication.
d. Develop appropriate speech dynamics in professional situations.
e. Focus on communication skills and social graces necessary for effective communication.

UNIT I
Phonetics
Sounds, Symbols, Stress and Intonation.
Pronunciation – Mother tongue influence – Indianisms etc.

UNIT II
Reading Comprehension
Strategies, Reading skills – Skimming and Scanning,
Intensive and Extensive reading.

UNIT III
Idioms & Phrases
Idioms of variety.

UNIT IV
Interactive classroom activities.
Jam– (Guided & Free) – Extempore –Elocution – Telephonic Skills.
Articulation and flow of oral presentation – voice modulation – content generation – Key Word Approach (KWA).

UNIT V

Communication Skills

Greeting and Introducing; Making Requests; Agreeing and disagreeing; Asking for and giving permissions; Offering help; Art of small talk; making a short formal speech; Describing people, places, events & things.

LEARNING RESOURCES:

1. A Course in Listening & Speaking II, Foundation books by G. Raja Gopal (UNIT – I) & (UNIT-IV), 2012
2. Books on GRE, IELTS & TOEFEL (UNIT –II)
3. English Idioms by Jennifer Seidl W. Mc Mordie, OUP, V Edition , 2009
4. Interactive classroom activities. (10 titles -CUP) (UNIT-IV)
5. A course in English Communication – by Kiranmai Dutt, Rajeevan, C.L.N Prakash (UNIT -V), 2013.
6. Better English Pronunciation - J.D.O' Connor, Second Edition, 2009, Cambridge Semester Press. (UNIT-I).

SOFTWARE:

1. Pronunciation power I & II
2. Author plus - Clarity.
3. Call Centre Communication - Clarity.

CE /ME 156	WORKSHOP PRACTICE	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

1. To provide the students hands on experience to make different joints in carpentry with hand tools like jack plane, various chisels & hand saws
2. To provide the students hands on experience to make different joints in welding with tools & equipment like electric arc welding machine,
3. TIG Welding Machine, MIG Welding Machine, hack saws, chipping tools etc.
4. To provide the students hands on experience to make different joints in Sheet metal work with hand tools like snips, stacks, nylon mallets etc.
5. To provide the students hands on experience to make different connections in house wiring with hand tools like cutting pliers ,tester ,lamps& lamp holders etc .

COURSE OUTCOMES:

a. To familiarize with the basics of tools and equipment used in Carpentry, Tin Smithy, Welding and House Wiring.
b. The production of simple models in the above four trades

LIST OF EXPERIMENTS:

Minimum three experiments should be conducted from each trade

1. CARPENTRY

To make the following jobs with hand tools
a) Lap joint
b) Lap Tee joint
c) Dove tail joint
d) Mortise & Tenon joint
e) Cross-Lap joint

2. WELDING USING ELECTRIC ARC WELDING PROCESS / GAS WELDING.

The following joints to be welded.
a) Lap joint
b) Tee joint
c) Edge joint
d) Butt joint
e) Corner joint

3. SHEET METAL OPERATIONS WITH HAND TOOLS.

a) Rectangular Tray
b) Triangular Tray

c) Pipe Joint
d) Funnel
e) Rectangular Scoop

4. HOUSE WIRING
a) To connect one lamp with one switch
b) To connect two lamps with one switch
c) To connect a fluorescent tube
d) Stair case wiring
e) Go down wiring

REFERENCE BOOKS:

1. *Kannaiah P. & Narayana K. C., "Manual on Work Shop Practice", Scitech Publications, Chennai, 1999.*
2. *Workshop Lab Manual , R.V.R. & J.C. College of Engineering , Guntur*

II YEAR

ME 201	COMPLEX ANALYSIS AND NUMERICAL SOLUTIONS	L	T	P	M	C
		3	1	-	100	3

COURSE OBJECTIVES:

1. To provide knowledge on complex analysis because technology we rely on requires scientists and engineers to understand this topic. Complex analysis is widely used in the fields of science and technology.
2. To provide knowledge on complex integration.
3. To provide knowledge on singularities, poles and residues.
4. To provide knowledge on numerical solution of ordinary differential equations.
5. To provide knowledge on numerical solution of partial differential equations.

COURSE OUTCOMES:

On completion of this course, students will be able to:

a. Apply Cauchy-Riemann equations and harmonic functions to problems of fluid mechanics, thermodynamics and electro-magnetic fields.
b. Evaluate complex line integrals.
c. Find singularities of complex functions and determine the values of integrals using residues.
d. Find numerical solution of ordinary differential equations.
e. Find numerical solution of partial differential equations.

UNIT I - Complex Functions **(12)**

Introduction - Derivative of complex function - Analytic functions - The necessary and sufficient conditions for the analyticity of the function (without proof) - Cauchy-Riemann equations in polar form - Harmonic functions
Milne-Thomson method, orthogonal system.

UNIT II - Complex Integration **(12)**

Complex integration - Line integrals
Cauchy's integral theorem, Cauchy's integral formulae.

UNIT III – Series and Residues **(12)**

Taylor's and Laurent's expansions (without proofs).
Singularities – Poles and Residues – Cauchy's residue theorem (without proof).

UNIT IV – Numerical Solutions of Ordinary Differential Equations (First order) **(12)**

Solution by Taylor's series – Picards method
Euler's method - Runge-Kutta method of fourth order.

UNIT V - Numerical Solutions of Partial Differential Equation (12)

Classification of Partial differential equations of the second order – Laplace's equation. Poisson's equation.

LEARNING RESOURCES:

TEXT BOOK:

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.

REFERENCE BOOK:

1. Advanced Engineering Mathematics by Erwin Kreyszig , John Wiley & Sons..

WEB REFERENCES:

- https://www.math.ust.hk/~maykwok/courses/ma304/06_07/Complex_4.pdf
- https://espace.library.uq.edu.au/view/UQ:239427/Lectures_Book.pdf

ME 202	MECHANICS OF MATERIALS- I	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

1. Learn the basic concepts of stress, strain and their relations based on linear elasticity, material behaviors due to different types of loading.
2. Understand stresses and deformation in a member due to an axial loading. Also to estimate the thermal stresses, strains and strain energy in members subjected to axial loading.
3. Derive mathematically, torsion equation and apply the torsion equation to compute torsion stresses in solid and hollow shafts. Understand the concept of shear force and bending moment with respect to beams and to draw the shear force and bending moment diagrams.
4. Understand bending and shear stresses in beams of various cross sections under different loading conditions.
5. Understand and analyze combined stresses and strains at a point across any plane in a two dimensional system using analytical and graphical approaches.

COURSE OUTCOMES:

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

a. Estimate stresses in structural members subjected to tension, compression and torsion and bending using fundamental concepts of stress, strain and elastic behavior.
b. Compute thermal stresses, strains and work due to strain energy in various structural members.
c. Calculate torsional stresses in structural members subjected to twisting loads.
d. Draw shear force and bending moment diagrams and compute bending and shear stresses in beams under different loading conditions.
e. Apply graphical and analytical methods to determine principal stresses and strain and locate principal planes.

UNIT I (12)

Tension, Compression and Shear: Introduction, Normal Stress and Strain, Stress - Strain Diagrams, Elasticity and Plasticity, Linear Elasticity and Hooke's Law, Poisson's ratio, volumetric strain, Bulk Modulus, Shear Stress and Strain, Allowable Stresses and Loads.

Axially Loaded Members: Introduction, Deflections of Axially loaded Members - bars of uniform sections - stepped bars, bars of uniformly tapering sections.

UNIT II (12)

Statically Indeterminate Axially Loaded Members: Analysis of statically indeterminate members by Flexibility method and Stiffness method.

Thermal Stresses and Strains, Strain energy of axially loaded members subjected to static load.

UNIT III (12)

Torsion: Introduction, Torsion of Circular Bars, Pure Shear, Relationship between Modulus of Elasticity(E) and Modulus of Rigidity(G), Transmission of power by circular shafts, Strain Energy in uniform Torsion for Statically determinate Members.

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.

UNIT IV (12)

BENDING STRESSES: Theory of simple bending, bending equation, flexural formula, bending stresses – rectangular and circular sections (solid and hollow), triangular, beams with flanges such as I and T sections.

SHEAR STRESSES: Introduction, shear formula, Shear stress distribution across various cross sections like rectangular, circular, triangular, beams with flanges such as I and T sections.

UNIT V (12)

Analysis of Stress and Strain: Introduction, Plane Stress, Plane strain, Principal Stresses and Maximum Shear Stress, Hooke's Law for Plane Stress, UNIT Volume change, Strain Energy Density, Mohr's Circle for Plane Stress, plane strain, Mohr's circle for plane strain.

LEARNING RESOURCES

TEXT BOOKS:

1. Mechanics of Materials by James M. Gere and Barry J. Goodno, Published by Cengage Learning, 8th edition.
2. Strength of materials by Sadhu Singh, Khanna Publishers, 11th Edition.

REFERENCE BOOKS:

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

COURSE RELEVANT WEB SITES FOR REFERENCE

- *http://nptel.iitm.ac.in/*
- *www.learnerstv.com/Free-Engineering-video-lecture-courses.htm*

ME 203	ELECTRICAL TECHNOLOGY	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Study of network elements, various conventions, network theories based on DC and based on AC
2. The poly phase circuits and the advantages of poly phase systems and the star and delta conversions will be studied.
3. Learns the functions and construction of DC machines, AC Machines and Transformers.
4. A brief idea of Induction motors i.e., Three phase and Single phase Induction motors along with Synchronous Machines is given.
5. The utilization of Electrical Measuring Instruments, Electrical Heating and Electric Traction.

COURSE OUTCOMES:

Upon the completion of this subject the Graduate will have a wide idea on:

a. The concepts of network elements, various conventions, network theories based on DC and based on AC.
b. Construction, Operation, characteristics and applications of DC Machines.
c. Construction and Operation of 1-phase transformer and 3-phase induction motors.
d. Construction, Operation of 1-phase induction motors and its starting methods and alternators.
e. Measurement of electrical quantities with Measuring Instruments and Utilization of Electrical Energy.

UNIT I (12)

DC and AC circuits: Kirchhoff's laws, simple circuits -Alternating current -waveforms – Peak factor, Form factor, RMS - Average values-simple R-L-C- series and parallel circuits. Active, reactive and apparent power, Power factor.

Poly-phase circuits: Advantages of poly-phase circuits over 1-phase circuits, relation between line and phase voltages, relation between line and phase currents in star/delta balanced circuits.

UNIT II (12)

DC Generators: Constructional features and Operation of DC generators, E.M.F. Equation, Methods of excitation-Load characteristics of shunt, series, compound generators Different Power Stages, Losses and efficiency, Condition for maximum efficiency.

DC Motors: Constructional features and Operation of DC motor, Torque Equation, Methods of excitation-characteristics of shunt, series, compound motors, Different Power Stages, Losses and efficiency, Condition for maximum Mechanical power, principle of starters-3 point starter only.

UNIT III (12)

Transformers: Construction and working principle of operation, types, E.M.F.equation, equivalent circuit - regulation – losses and efficiency - open circuit and short-circuit tests.

3-Phase Induction machines: Constructional features-Principle of operation, concept of rotating magnetic field, torque equation, torque-slip characteristics, Principle of starters.

UNIT IV (12)

1-Phase Induction machines: Fundamentals of single-phase induction motors and their starting.

Synchronous machines: Principle - constructional features, types alternators, E.M.F.equation-applications of synchronous motors.

UNIT V (12)

Measuring Instruments: Principles and operation of moving - coil and moving-iron instruments-Dynamometer-type wattmeter.

Utilization: Principles of resistance and induction heating - principles of electrical traction-speed time characteristics.

LEARNING RESOURCES

TEXT BOOKS:

1. *Electrical Technology by B.L. Theraja, (S. Chand & Co.), 2005. Vol-I and Vol-II*
2. *A course in Electrical Power by Soni, Gupta, Bhatnagar, Dhanpatirai& Sons, 1963.*

REFERENCE BOOKS:

1. *Electrical Technology by H. Cotton (Sir Issac Pittman & Sons Ltd., London), 1944.*
2. *Utilization of Electrical Energy by Openshaw&Taylor , English Semester press, 1946*
3. *Generalsied theory of Electrical Machines by P.S. Bimbra, Khanna Publishers, 1995.*
4. *Electrical Technology by B. Hughes (ELBS) , Longman ,1960*

COURSE RELEVANT WEBSITES:

- *http://ieee-elearning.org/course/category.php?id=18*
- *http://www.virtualcollege.org/course/registered_pages/b123/9467.htm*
- *NPTEL -Electrical Technology*

ME 204	BASIC THERMODYNAMICS	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

1. To make the student distinguish among system, boundary and surroundings and grasp the concept of temperature and to know the Perfect gas laws and Real gas law.
2. To make the student know about thermodynamic definition of work and heat and their UNITs and explain the internal energy & enthalpy
3. To make the student to know about importance of Steady Flow Energy Equation and its application to various engineering devices and to understand the concepts of heat engine and refrigerator and know the rate of conversion of heat into work and calculate Thermal Efficiency and COP.
4. To make the student to know the difference between irreversible and reversible processes and learn about Carnot reversible heat engine and different theorems related to it and to know about concept of Entropy and its estimate the change of entropy in any process and in a cycle and calculate maximum work that can be obtained from a system.
5. To make the student 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:

a. Students can analyze and synthesize various thermodynamic systems, processes and cycles.
b. Students can evaluate work transfers for various non flow processes and able to apply the SFEE to various engineering applications.
c. Students can able to determine the efficiency of heat engine and COP of refrigerator and heat pump.
d. Students can evaluate the entropy changes for various non flow processes and can apply principle of increase of entropy for various engineering applications.
e. Students can evaluate the availability of the energy supplied and find out various losses (Irreversibilities) of the systems.
f. Students can evaluate the air standard efficiency and MEP of Otto, Diesel and Dual Cycles and Brayton cycle.

UNIT I (12)

Fundamental Concepts and Definitions: Introduction- Macroscopic and microscopic points of view, Thermodynamic system and control volume, Thermodynamic properties and state of a substance, Thermodynamic processes and Cycle. Thermodynamic equilibrium and Quasi-static Process- Zeroth law of thermodynamics -Concept of temperature and measurement.

Perfect gases: Introduction, Gas laws, Characteristic gas equation, Avogadro's law, Universal gas constant, Relation between specific heat and gas constant –Law of reversible adiabatic expansion of an ideal gas, Properties of a perfect gas- and real gases –Problems on perfect gases

UNIT II **(12)**

Work and Heat: Thermodynamic work- Definition and UNITs, Work done at the moving boundary of a system, Work done in various non-flow processes- Other types of work transfer, Net work done by a system -Heat transfer definition and UNIT, Heat transfer – A path function, Comparison of heat and work.

First Law of Thermodynamics for Non-Flow Systems: First law of Thermodynamics for a closed system undergoing a cycle and for a change of state of system, Energy – property of system, Different forms of stored energy -Internal energy and enthalpy, Specific heat at constant volume and Specific heat at constant pressure –Energy of an isolated system –Perpetual motion machine of I kind (PMMI)..

UNIT III **(12)**

First Law of Thermodynamics for Flow Systems: Control Volume, Steady flow process, Mass balance and Energy balance –Simple steady flow process- First law of thermodynamics for a control volume, Steady flow energy equation and its application to engineering equipment –Boiler, Compressor, Turbine and Nozzle.

Second Law of Thermodynamics: Limitations of first law, Qualitative difference between work and heat , Cyclic heat engine, Energy reservoirs, Refrigerators and Heat pump Statements of Second law of Thermodynamics, Equivalence of Kelvin Planck and Clausius statements, Perpetual motion machine of II kind(PMMII).

UNIT IV **(12)**

Ideal (Reversible) cycle: Reversible and Irreversible processes, Causes of Irreversibility, Conditions for reversibility- Carnot cycle, Carnot heat engine and Reversed heat engine Carnot's theorem, Corollary of Carnot's theorem-Absolute thermodynamic temperature scale-Third law of thermodynamics.

Entropy: Introduction-Two reversible adiabatic processes cannot intersect each other-Clausius theorem- Concept of Entropy- Entropy- property of a system- Temperature-Entropy plot-Inequality of Clausius- Entropy change in an irreversible process, Principle of increase of entropy, Applications, Entropy change of an ideal gas.

UNIT V **(12)**

Availability & Irreversibility: Available energy and unavailable energy –Available energy referred to a Cycle- Decrease in available energy when heat is transferred through a finite temperature difference-Quality of energy, Law of Degradation of energy- Maximum work in a reversible process- Useful work -Dead state- Availability – Availability in Steady flow process and Non flow process –Irreversibility.

Air standard Cycles: Introduction-Air standard efficiency-Piston cylinder arrangement-some definitions-Mean effective pressure and power output-Air standard cycles – Carnot cycle, Otto, Diesel, and Dual Combustion cycles -Air standard efficiency and MEP derivations – Comparison between Otto, Diesel and Dual combustion cycles.

LEARNING RESOURCES

TEXT BOOKS:

1. Thermodynamics An Engineering Approach– Y. A. Cengel & M. A. Boles, TMH, 6th Edition, New Delhi, 2010.
2. Fundamentals of Classical Thermodynamics – G. Van Wylen, R.Sonntag, C.Borgnakke, John Wiley & Sons(Asia) Pvt Ltd., 4th Edition, 1997.
3. Engineering Thermodynamics- P.K.Nag, TMH, New Delhi, 2009.

REFERENCE BOOKS:

1. Thermodynamics – J.P.Holman, 4th Edition, MGH, New York, 2002.
2. Thermal Engineering – M.M. Rathore, TMH, New Delhi,2010
3. Treatise on Heat Engineering – V.P.Vasandhani and D.S. Kumar , 4th Edition Metropolitan Book Co. Pvt Ltd,.
4. Thermal Engineering -Rajput, LaxmiPubl, New Delhi, 2012.

WEB RESOURCES

- www.nptel.iitm.ac.in
- ww.sciencedirect.com
- www.2.accessengineeringlibrary.com.
- www.asmedl.aip.org
- www.ieee.org/ieeexplore
- www.springerlink.com

ME 205	THEORY OF MECHANISMS AND MACHINES	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

1. To provide basic concepts on mechanisms, machines and analyze the velocities various links in mechanisms.
2. To introduce the instantaneous centre concepts for analysis.
3. Brief study on synthesis and concepts of Type, Number and Dimensional synthesis.
4. To introduce the CAMs and their design regards to synthesis.
5. To introduce various concepts on gears, classification and types.

COURSE OUTCOMES:

a. Students can understand various mechanisms and terminology used in kinematics.
b. Students can analyze the mechanisms and machines regarding velocities and accelerations.
c. Students can understand the concepts of synthesis in respect of CAM systems.
d. Students can understand the Gear terminology and able to analyze the spur gear trains.
e. To understand and analyze the concept of gear trains.

UNIT I **(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.

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 II **(12)**

Instantaneous centre: Notation, Number of I - Centres, Arndd Kennedy's theorem, Locating I - Centres, Angular velocity by I - Centre Method.

Accelaration 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 III **(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 IV (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 gears: Interference in Involute Gears, Minimum number of Teeth, Interference between Rack and Pinion, Undercutting, Comparison of Cycloidal and Involute tooth forms.

UNIT V (12)

Gear Trains: Introduction to simple Gear Train, Compound Gear Train, Reverted Gear train, Planetary or Epicyclic Gear Trains.

Analysis of Gear trains: Analysis of Epicyclic Gear Train, Torques in Epicyclic gear Trains. Tabular and Algebraic Methods.

LEARNING RESOURCES

TEXT BOOKS:

1. *Theory of Machines of by S.S.Rattan. TMH, second re print, 2009.*
2. *Theory of Mechanisms and Machines by C.S.Sharma, Kamlesh Purohit, PHI, 2006.*

REFERENCE BOOK:

1. *Theory of Mechanisms and Machines by Ghosh and Mallik, East West Press, New Delhi, Re-print 2000.*
2. *Theory of Mechanism and Machine by J.E. Shigley, MGH , 2nd Edition.*

WEB REFERENCES:

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

ME 206	FLUID MECHANICS & HYDRAULIC MACHINES	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

1. To study and know Physical quantities and terms important in fluid flow and analyze fluid problems under static conditions.
2. To study and know physical quantities & terms important in fluid flow &analyze fluid problems in motion.
3. To study various losses of energy in fluid flow through pipes and draw HGL &TEL of fluid flows through pipes.
4. To study and know the application impulse - momentum principle.
5. To study the Impact of jets on plates with different positions
6. To study and understand the working of various turbines and pumps such as pelton wheel, Francis and Kaplan turbines, centrifugal and reciprocating pumps.

COURSE OUTCOMES:

a. The student will be able to determine the static forces on any surface or body, analyze the stability of a floating body.
b. The student will be able to use continuity, momentum and energy principles to analyze fluid flow problems.
c. The student will be able to use applications of Bernoulli's equation to various flow measuring devices.
d. To determine loss of head due to friction in flow through pipes.
e. To apply HGL, TEL & maximum power transmission through pipes which is useful for water distribution pipe lines in towns and hydraulic power stations.
f. The student will be able to learn the working principles water turbines and pumps.

UNIT I **(12)**

Introduction: Definition of fluid, Properties of a fluid – density, specific weight, specific gravity, viscosity, compressibility, surface tension, capillarity, vapor pressure, Classification of fluids.

Fluid Statics: Pressure, variation of pressure in fluid, measurement of pressure – simple and differential manometers, pressure head, Pascal's law, Total pressure and center of pressure on submerged plates, Buoyancy and metacentric height.

UNIT II **(12)**

Fluid Kinematics: Type of fluid flow, flow patterns, velocity potential, stream function, flow net, continuity equation & Bernoulli's equation.

Flow through Pipes: Laws of fluid friction, major losses, Darcy weisbach equation, minor losses (sudden expansion and contraction only), hydraulic gradient line, total energy line, pipes in series and parallel.

UNIT III **(12)**

Impulse Momentum Equation: Impulse momentum Principle, Equation and Application, Force on pipe bend.

Impact of Jets: Introduction, Force exerted by a fluid jet on stationary and moving flat plate and curved vanes.

UNIT IV **(12)**

Hydraulic Turbines: Elements of hydro-electric power plants: Heads and Efficiencies of Pelton wheel, Francis turbine and Kaplan turbine.(Numerical problems not included)

Performance of Turbines: Performance under UNIT quantities, Performance under specific conditions - Specific speed, Performance characteristic curves.

UNIT V **(12)**

Pumps: Working principles of Centrifugal and Reciprocating Pumps. (Numerical problems not included)

Dimensional Analysis & Model Similitude: Introduction, Buckingham's Pi theorem, Types of similarities, Force ratios, Dimensionless numbers, Model Laws-Reynolds and Froude law, Types of models, Scale effect. (Qualitative treatment only)

TEXT BOOK:

1. Hydraulics and Fluid Mechanics --P.N.Modi & S.M.Sethi, Standard Publishers Distributors,
2. Fluid Mechanics & Fluid Power Engineering - D.S.Kumar, SK Kataria & Sons, New Delhi.
3. Fluid Mechanics and Fluid machines – Agarwal, TMH.

REFERENCE BOOKS:

1. Fluid Mechanics & Hydraulic Machines - R.K.Bansal, Laxmi Publications, Ltd., 2005.
2. Fluid mechanics including Hydraulic machines – A.K.Jain.
3. Fluid Mechanics – K.L.Kumar, S.Chand Publishers, 2008.

WEB REFERENCES:

http://www.iscid.org/encyclopedia/Fluid_Mechanics.
http://www.iscid.org/encyclopedia/Fluid_Mechanics.
www.mastep.sjsu.edu/resources/engineer.htm
www.waterengr.com/
http://www.efluids.com/
www.pumps.org/

WEB REFERENCES:

- *http://www.iscid.org/encyclopedia/Fluid_Mechanics.*
- *http://www.iscid.org/encyclopedia/Fluid_Mechanics.*
- *http://fluid.power.net/*
- *www.mastep.sjsu.edu/resources/engineer.htm*
- *www.hydraulicspneumatics.com/*
- *www.waterengr.com/*
- *http://www.efluids.com/*
- *http://fluid.power.net/*
- *www.pumps.org/*

ME 251	FM & SM LAB	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

FM LAB

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.

SM LAB

1. understanding the basic strength of materials principles by conducting experiments
2. 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:

FM LAB

Upon completion of this course, students should be able to:

a. Apply fundamental knowledge of fluid mechanics in solving problems and making design of pressure-pipe in Mechanical and environmental engineering
b. Understand the basics of hydraulic machinery and their operation design in water systems.
c. Conduct experiments in flow measurement, hydraulic machinery and interpreting data from experiments, as well as documenting them in engineering reports

SM LAB

a. Ability to design and conduct experiments, acquire data, analyze and interpret data
b. Physical insight into the behaviour materials and structural elements, including distribution of stresses and strains, deformations and failure modes
c. Write individual and group reports: present objectives, describe test procedures and results, synthesize and discuss the test results, present conclusions.

Any Ten Experiments out of the following are to be performed:

FLUID MECHANICS LAB:

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

7. Pelton turbine - To draw the performance characteristic curves and determination of overall efficiency

8. Francis / Kaplan turbine - To draw the performance characteristic curves and determination of overall efficiency.

STRENGTH OF MATERIALS LAB:

1. (a) Rockwell Hardness test - Determination of Hardness Number for different metal specimens such as mildsteel, cast iron, Brass, Aluminum (b) Brinnell's Hardness Test,

2. Impact Test - (a) Charpy and (b) lzod: Determination of impact strength of mild steel and cast iron specimens

3. Tension Test on UTM - Determination of mechanical properties of mild steel and cast iron specimens.

4. Tests on helical spring - Determination of stiffness of Helical springs.

5. To find the modulus of rigidity by conducting torsion test on solid circular shaft

ME 252	MACHINE DRAWING AND CAD LAB	L	T	P	M	C
		-	-	3	100	2

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.
5. To make the students well versed in using the AUTOCAD drafting software for drawing various mechanical components and Assemblies.

COURSE OUTCOMES:

At the end of the course, students will be able to identify and classify

a. The functionalities of various machine elements such as vices, bearings, screw jacks, shafts, fasteners, keys, cotters, pins, etc., and their assemblies.
b. The students will be able to draw full and half sectional views of machine parts and their assemblies both manually and by using software packages such as AUTOCAD.

MACHINE DRAWING:

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 : Stuffing Box , Screw Jack , Eccentric , Pipe - Vice

COMPUTER AIDED DRAFTING (CAD): using AUTO CAD

1. **Introduction:** Basic Drawing, Modify, editing & dimensioning commands, layers, AutoCAD - Screen Menus
2. **Sectional views of castings**
3. **Assembly Drawings :** (Any Two)

a. Pipe vice, b. Lathe Tail Stock; c. Swivel Bearing; d. Screw Jack

4. **Part Drawings :** (Any Two)

a. Single tool post; b. Petrol Engine Connecting Rod; c. Angular - plummer block

LEARNING RESOURCES

Text Book:

1. Machine Drawing by K.L.Narayana, P.Kannaiah & K.Venkata Reddy, New Age International, 3rd Edition .

2. AutoCAD-14 for Engineering Drawing Made Easy by P.Nageswara Rao, TMH, 2010.

REFERENCE BOOKS :

1. Machine Drawing by K.R.Gopala Krishnan, Subhas Publications, 20th Edition, 2007.

2. An Introduction to AutoCAD 2000 by A.Yarwood, Longman Publishers.

WEB REFERENCES:

- *http://machinedrawing.blogspot.in/2006/04/chapter-6.html*
- *https://www.scribd.com/doc/138436976/Lecture-1-Introduction-to-AutoCAD-ppt*
- *http://tutorial45.com/learn-autocad-basics-in-21-days/*

ME/EE 253	PROFESSIONAL COMMUNICATION SKILLS LAB	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

The Professional Communication Skills Lab prepares students to

1. Improve the dynamics of professional presentations.
2. Develop the ability to compeer professional occasions.
3. Enable to read news paper for their communicative competence.
4. Equip with effective business correspondence.
5. Develop in them communication and social graces necessary for functioning.
   i. for employable ready skills
   ii. win in the job interviews
   iii. Build confidence to handle professional tasks.

COURSE OUTCOMES:

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

a. Develop effective communication and presentation skills.
b. Learn corporate etiquette - organizing and managing professional events.
c. Understand how reading enhances their communicative competency.
d. Conduct effective correspondence and prepare reports which produce results.
e. Develop all-round personalities with a mature outlook to function effectively in different circumstances.

UNIT I

Presentation skills:

a. Key presentation skills inspired by Steve Jobs – You Tube.
b. Personality & finishing skills training videos.

How to make Effective Presentations, Methodology, Structure, using Technology and Conclusion.

UNIT II

Speech writing:

a. Welcoming guests on to the stage.
b. Proposing vote of thanks.

Invite and thank people with professional etiquette

UNIT III

Reading skills:

a. News paper reading.
b. Reading and interpretation.

News paper reading – loud reading within the groups.
Reporting the news with one another without the help of the news paper.
(Besides this, motivate students to read News Paper every day without fail.)

UNIT IV

Writing Skills:

Report writing

a. Feasibility report.
b. Project report.

(Writing an Abstract - Parts of a report - Title page – Declaration - Acknowledgements – Table of contents – Introduction – Conclusion – Citations – References – Appendices.)

UNIT V

Career skills:

a. Resume & Cover letter.
b. Interview – The purpose & preparation for an interview.

Discover oneself – Self Introduction – Social background (family, home and town) – interests, Hobbies, likes & dislikes (persons, places, food, music, etc) – Strengths, Weaknesses, Skills, Qualities, Achievements – Opinions (love, life, marriage, politics, India, etc) what is life according to me? A creative narration with factual information is expected.

Effective **Resume** writing: structure and presentation – planning and defining the career objective – strengths and skills set – format - cover letter

Facing **Interviews**: Interview Process – Understanding employer expectations – Pre- interview planning – Opening strategies – Answering strategies, Frequently Asked Questions(FAQs).

LEARNING RESOURCES:

1. Business Communication, II Ed, OUP, by Meenakshi Raman & Prakash Singh, 2012.
2. Technical Communication – English Skills For Engineers, II Ed, OUP, by Meenakshi Raman & Sangeetha Sharma - (UNIT–IV), 2011.
3. Technical Communication - Principles and Practice, II Ed, OUP, by Meenakshi Raman & Sangeetha Sharma - (UNIT–V), 2015.

SUGGESTED SOFTWARE:

- TOEFL Mastery, Rosetta Stone, TED Talks, Globarena, Clarity.

INTERNET SOURCES:

- www.esl-lab.com,
- www.eslgold .com

ME 207	TRANSFORMATION TECHNIQUES & DISTRIBUTIONS	L	T	P	M	C
		3	1	-	100	3

COURSE OBJECTIVES:

1. To provide knowledge on Fourier series.
2. To provide knowledge on Fourier transforms.
3. To make the student to learn Laplace and inverse transforms of a function.
4. To impart the basic principles of various probability distributions.
5. To provide basic knowledge of statistical inference and applying it to practical problems.

COURSE OUTCOMES:

On completion of this course, students will be able to:

a. Find Fourier series.
b. Find Fourier transforms.
c. Find Laplace and inverse transforms of a function.
d. Apply knowledge of distribution theory to various data.
e. Test hypotheses and draw inference for engineering problems

UNIT I - Fourier Series **(12)**

Dirichlet's conditions - General Fourier series.
Half range sine and cosine series - Parseval's formula.

UNIT II - Fourier Transforms **(12)**

Statement of Fourier integral theorem (without proof) - Fourier transform - Fourier Sine and Cosine transforms.
Properties - Convolution theorem (without proof) - Parseval's identity.

UNIT III - Laplace Transforms **(12)**

Transforms of simple functions – Basic operational properties – Transforms of derivatives and integrals.
Inverse transforms – Convolution theorem (without proof).

UNIT IV – Distributions **(12 hours)**

Binomial Distribution, Poisson approximation to the Binomial Distribution.
Normal Distribution, Normal approximation to the Binomial Distribution, properties and applications to Industrial problems.

UNIT V – Testing Of Hypothesis (12 hours)

Large sample tests based on Normal distribution – Hypothesis concerning one Mean, Hypothesis concerning two means.
Small sample tests based on t and F-distributions - Hypothesis concerning one Mean, Hypothesis concerning two means. Hypothesis concerning one Variance, Hypothesis concerning two variances.

LEARNING RESOURCES:

TEXT BOOK:

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.
2. Probability and Statistics for Engineers by Richard A Johnson , PHI Pub. , 6th Edn.

REFERENCE BOOK:

1. Advanced Engineering Mathematics by Erwin Kreyszig , John Wiley & Sons..

WEB REFERENCES:

- http://www.slideshare.net/nsihag/fourier-series-14672766
- http://mathworld.wolfram.com/LaplaceTransform.html

ME 208	MECHANICS OF MATERIALS II	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

1. Understand and analyze beam deflections using various methods like double integration approach, Macaulay's method, Moment area method, energy methods... etc.
2. Analyze buckling behavior in columns with various support conditions and to analyse statically indeterminate beams using integration approach and moment area method.
3. Analyze continuous beams using Claypeyron's theory and curved beams of varying sections using Winkler-bach theory.
4. Study the pressure vessels, their classification and to estimate various stresses such as radial, circumferential, longitudinal and shrinkage induced in them.
5. Understand the concept of shear centre, shear flow for various sections and to estimate centrifugal stresses in various rotating elements such as rings, discs...etc.

COURSE OUTCOMES:

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

a. Estimate beam deflections using various approaches like integration methods, moment area method and energy methods.
b. Determine the critical loads in columns with different support conditions using Euler's and Rankine's theories.
c. Analyze fixed beams, continuous beams and curved beams of various cross sections by adopting various theories such as Clayperon's theory, winkler-bach theory...etc.
d. Analyse and design thin and thick pressure vessels as well as compound cylinders.
e. Calculate the shear centre for various sections and centrifugal stresses in case of rings and discs.

UNIT I (12)

Deflections of Beams: Introduction, Differential Equations of the Deflection Curve, Deflections by Integration of the Bending MomentEquation, Deflections by integration of the Shear Force and Load equations.

Deflections by Moment Area Method, Macaulay's Method and Deflections of beams by strain energy method - Deflections by using Castigliano's first theorem.

UNIT II (12)

Columns: Introduction, Buckling and Stability, Columns with Pinned ends, Columns with other support conditions, Limitations of Euler's Formula, Rankine's Formula, Columns with eccentric Axial Loads, Secant formula

Statically Indeterminate Beams: Introduction, Fixed and propped cantilever beams - Analysis by the differential equations of the Deflection curve, Moment Area Method

UNIT III (12)

Continuous Beams: Introduction, Clapeyron's theorem of three moments, Beamswith constant and varying moments of inertia.

Curved Beams: Stresses in Beams of small and large initial curvature, The Winkler-Bach theory, Stresses in Crane Hook and C-Clamp with Rectangular, Circular and Trapezoidal cross-sections.

UNIT IV (12)

Thin Pressure Vessels: Introduction, thin cylindrical pressure vessels – hoop and longitudinal stresses, change in dimensions due to internal pressure, Thin Spherical pressure vessels - hoop stresses, change in dimensions due to internal pressure.

Thick Cylindrical Pressure Vessels: Introduction, Lame's theory – stresses in a thick cylindrical shell, Compound Cylinders – shrinkage stresses, resultant stresses, initial difference in radii at the junction of a compound cylinder.

UNIT V (12)

Shear Centre: Bending Axis and Shear Centre, Position of Shear Centre, Shear flow, Shear Centre of Channel section, Angle section, T- section and I- section.

Centrifugal Stresses: Introduction, Rotating Ring, Rotating Disc, Rotating Disc of uniform strength.

LEARNING RESOURCES

TEXT BOOKS:

1. Mechanics of Materials, James M. Gere and Barry J. Goodno, Published by Cengage Learning, 8th edition.
2. Strength of materials by Sadhu Singh, KhannaPublishers, 11th Edition.

REFERENCES:

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

WEB RESOURCES:

- *http://nptel.iitm.ac.in/*
- *www.learnerstv.com/Free-Engineering-video-lecture-courses.htm*
  http://en.wikibooks.org/wiki/Strength_of_Materials

ME 209	CASTING , WELDING AND METAL WORKING PROCESS	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

During the course, students would gain the knowledge of

1. Basic aspects of pattern preparation, constituents, preparation and testing of sand molds.
2. Basics of cupola furnace and operations.
3. Principle, procedure, and applications of various special casting methods.
4. Various defects, their causes and remedies and Procedure for cleaning of casting.
5. Principles of operation, applications, advantages and disadvantages of various welding processes. Various Welding defects, their causes and remedies.
6. Basics of hot and cold working processes.
7. Fundamentals of rolling, forging, extrusion, tube making, swaging, spinning, coining and wire drawing processes and their applications.
8. Fundamentals of sheet metal working and high energy rate forming processes.

COURSE OUTCOMES:

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

a. Choose proper pattern material and able to design a pattern
b. Choose proper constituents and prepare sand molds
c. Control various casting defects.
d. Choose proper welding processes for the given application Control various welding defects.
e. Choose proper metal working processes for the given application

UNIT I (12)

Metal Casting: Introduction, advantages of Casting method, pattern: types, materials and allowances. Sand moulding procedure

Moulding materials and equipment Preparation, control and testing of moulding sands, Cores

UNIT- II

Fettling of castings, casting defects: causes, remedies and testing. Cupola: Description, operation and zones. **(6)**

Elements of gating system, Risering design: caine's method, modulus method. **(6)**

UNIT III (12)

Special Casting Methods: Permanent Mould Casting, Die Casting, Centrifugal casting, Investment casting, shell moulding, CO2 process and continuous casting.

UNIT IV **(12)**

WELDING: Gas and arc welding - Principles of oxy-acetylene welding, oxyacetylene flame cutting, MMAW (Manual metal arc welding), TIG, MIG, submerged arc welding. Resistance welding: principles, Butt welding, Spot welding, Seam welding. Thermit Welding, Electroslag welding, Laser beam welding. Ultrasonic welding and Adhesive bonding, Brazing & Soldering, welding defects - causes and remedies.

UNIT- V **(12)**

Metal Working Processes: Introduction, Hot and Cold working of metals. Rolling: Types of rolling mills, roll passes. Forging: Description and types of forging, defects in forged parts.
Extrusion: Classification, description and application of extrusion process, Tube making, Swaging, Spinning, Coining, Embossing and Wire drawing, Explosive forming and electro hydraulic forming.

LEARNING RESOURCES

TEXT BOOKS:

1. Manufacturing Technology-Vol- I by PN Rao,TMH , 3rd Edition , 2009.
2. Workshop Technology Vol.1 by S.K.Hazra Chowdary. Khanna Publishers.
3. A course in Work shop technology, Vol-I by B.S.Raghuvanshi, Dhanpatrai & Sons,9th Edition 2002.

REFERENCE BOOKS:

1. Welding Technology by Little, TMH , 2001.
2. Principles of Metal Casting by Heine, Loper, Rosenthal, TMH , 2005.
3. Manufacturing Engineering & Technology, Kalpakjain, Pearson Education, 4th Edition.

WEB REFERENCES:

NPTEL Lectures
http://teacher.buet.ac.bd/shabnam/14250_ch3.pdf
http://me.emu.edu.tr/majid/MENG364/2_casting.pdf
http://en.wikipedia.org/wiki/Metalworking

ME 210	APPLIED THERMODYNAMICS	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

1. To make the student understand what is a pure substance what are its properties and the process of generation of steam and how to evaluate different properties of steam and to know the working of different high pressure boilers, mountings and accessories.
2. To understand the working of components of Steam Power plant and to understand the thermodynamic cycle of steam power plant and methods of improving efficiency of plant
3. To know the working of various condensers and nozzles and calculate the exit velocity and areas of nozzle.
4. To know the working principles of steam turbine both impulse and reaction.
5. To make the student under the basic principles of refrigeration and air conditioning systems and to evaluate the cop and capacity of refrigeration Units.

COURSE OUTCOMES:

a. The student will be able to have clear idea about the properties of steam, the use of steam tables, use of Mollier chart and evaluate steam properties and able to understand the working of boilers, mountings and accessories.
b. Able to understand the Ranking cycle, Reheat and Regeneration cycles applicable for steam power plants.
c. Able to understand the working of steam nozzles, steam condensers.
d. Able to understand the working principles of impulse and reaction steam turbines and evaluate their efficiencies.
e. Able to grasp thorough knowledge of refrigeration and Air Conditioning principles and systems.
f. Able to understand about psychrometric properties, processes and
g. Psychrometric chart and Summer air conditioning system working.

UNIT I **(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.

UNIT II **(12)**

Vapor Power Cycles: Simple steam power cycle, Rankine cycle analysis – Representation on T-s and h-s diagrams, Actual power cycle – processes, Comparison of Rankine and Carnot cycle, Effect of pressure and temperature on the Rankine cycle performance.

Methods of Improving Performance: Mean temperature of heat addition, Reheat cycle, Ideal regenerative cycle, Regenerative cycle – Analysis.

UNIT III **(12)**

Team 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, condenser vacuum and vacuum efficiency, Condenser efficiency, Thermodynamic analysis, Air pumps, Capacity of air extraction pump.

UNIT IV **(12)**

Steam Turbines: Impulse Turbines: Types of steam turbines, Impulse turbines, pressure and velocity compounding, velocity diagrams, work output, power, blade efficiency and stage efficiency.

Reaction turbines: Working of reaction turbine, velocity diagrams, degree of reaction, work output, power, blade efficiency and stage efficiency, Governing of turbines, Overall efficiency and reheat factor.

UNIT V **(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-Dry and Wet compressions.

Psychrometry and Air conditioning: Introduction, Psychrometric properties, Psychrometric chart, Psychrometric processes-Summer air conditioning systems

LEARNING RESOURCES

TEXTBOOKS:

1. Thermodynamics An Engineering Approach– Y. A. Cengel & M. A. Boles, TMH, 6th Edition, New Delhi,2010.
2. Thermal Engineering- M.M. Rathore, TMH, New Delhi,2010
3. Fundamentals of Classical Thermodynamics – G. Van Wylen, R.Sonntag, C. Borgnakke, John Wiley & Sons(Asia) Pvt Ltd., 4th Edition, 1997.

REFERENCE BOOKS:

1. Treatise on Heat Engineering-V.P.Vasandani and D.S.Kumar, Metropolitan Book co, New Delhi, 4th Edition.
2. Thermodynamics -- J.P.Holman, 4th Edition,MGH, New York,2002.
3. Thermal Engineering ---Rajput, LaxmiPubl, New Delhi , 2012.
4. Refrigeration and Air Conditioning- R. S. Khurmi and Gupta

WEB REFERENCES:

http://www.iscid.org/encyclopedia/Tthermodynamics.
http://www.transtutors.com/

Note: Use of Steam Tables by R. S. Khurmi and Refrigeration and Psychrometric properties by M.L. Mathur and F.S. Mehta is permitted in Semester Examinations.

ME 211	ENGINEERING METALLURGY	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Provides a basic knowledge about the material properties and testing methods along with crystal structures and deformations.
2. Explains the importance of phase diagrams and study of variousinary and ternary phase diagrams.
3. Conveys the significance of various heat treatment processes and their effect on properties of steel
4. Provides basic concepts and applications of Ferrous, Non Ferrous metals & alloys
5. Explains various properties and applications of composite and ceramic Materials.
6. Explains concept of powder metallurgy and its applications.

COURSE OUTCOMES:

a. Gains the knowledge about the material properties and testing methods.
b. Differentiates various phase diagrams in a binary systems. Possess basic principles of ternary diagrams.
c. Gains the knowledge of phase transformation and able to compare the mechanism of both Martensitic and Bainitic phase transformations.
d. Recognizes the purpose of heat treatment and various heat treatment processes.
e. Familiar with Cast Iron, Steel, Copper, Aluminium and Nano materials in terms of its uses and applications
f. Gains knowledge in composite and ceramic materials and its applications
g. Familiar in powder metallurgy concepts, advantages, limitations and its wide applications.

UNIT I **(12)**

Metallurgy–Introduction, Classification of materials , Mechanical Properties of materials.

Testing and evaluation of properties :- Tensile test, Compression test, Hardness & impact testing.

Non destructive testing methods: Dye penetrant test, Ultrasonic test, Radiography and Eddy current testing.

UNIT II **(12)**

Constitution of Alloys and Phase diagrams: Necessity of Alloying, Types of Solid Solutions ,Gibbs Phase Rule Hume-Rothery's Rules, Lever rule, Isomorphous, Eutectic, Partial eutectic systems, Intermediate phases.

Iron –carbon system: Iron-Iron Carbide Phase Diagram, Transformations in the solid state – allotropy

UNIT III **(12)**

Heat Treatment Of Steels:TTT diagrams for eutectoid, hypo and hyper eutectoid steels, martensite and bainitic transformation.

Heat Treatment: Introduction and purpose of heat treatment, Annealing, Normalizing, Hardening, Tempering, Austempering and Martempering, Age hardening and Surface Hardening of Steels.

UNIT IV **(12)**

Ferrous and Non-ferrous alloys: : Properties, applications and limitations of Steels & Cast irons.Properties and applications of Copper, Aluminium and its alloys.

Ceramic materials : Crystalline ceramics, glasses, cermets, abrasive materials

Plastics: Injection and blow moulding techniques.

UNIT V **(12)**

Powder metallurgy: Manufacture of metal powders, procedure of fabrication of powder metallurgy product, industrial applications of powder metallurgy, advantages and limitations of powder metallurgy

Composite Materials: Classification based on matrix, classification based on reinforcement, Types of Matrices and Reinforcements. Examples and Applications.

LEARNING RESOURCES

TEXT BOOKS:

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:

1. Material Science and Metallurgy - R.B.Choudary - Khanna Pub , 1st Edition
2. A Text Book of Material Science and Metallurgy , O.P. Khanna , Dhanapat Rai Publiacations, 2012.

WEB REFERENCES:

- http://nptel.ac.in/courses/113106032/
- http://freevideolectures.com/Subject/Metallurgy-and-Material-Science
- https://www.freedu.in/courses/sub/47/

ME 212	BASIC ELECTRONICS AND MICROCONTROLLERS	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To introduce the concept of electronic circuits and theorems
2. To study the characteristics of semi conductor material
3. To analyze and design the circuit with diodes ,zener diodes and transistors
4. To study the working and principle of digital circuit
5. To study the various analog circuits
6. To introduce the concept of 8051 microcontroller

COURSE OUTCOMES:

After the successful completion of the course student will be able to.

a. Understanding construction operation and characteristics of semiconductor devices like diode, BJT, JFET & MOSFET.
b. Understand operation, characteristics & applications of op-amps.
c. Simplify Boolean functions using K maps and understand the operation.
d. Design procedure of simple combinational logic & Sequential logic circuits.
e. Understand the architecture of 8051 microcontroller.

UNIT I *Text book -1,2* **(12)**

Basic Circuit Theory Concepts: Mesh analysis & Nodal Analysis of Simple Electric circuits: Circuit theorems: Thevinen & Norton's Theorems.
Basic Electronic Devices: PN junction diode: Principle, characteristics: Zener diode; Principle, characteristics, Rectifiers: Definition, Half wave rectifier, Full wave rectifier; BJT: Principle & operation, Input, & output characteristics, Transistor as a switch, Transistor as an amplifier.FET: Principle & operation, characteristics of JFET, & MOSFET.

UNIT II *Text book -3* **(12)**

Analog Electronics: Operation amplifiers: Definition of op-Amplifiers, Block diagram of op -Amp, details of op - Amp characteristics, Op - Amp Configurations: Inverting configuration, Non- Inverting configuration.
Op Amplifiers Applications: Summing Amplifier, Difference Amplifier, Integrator, Differentiator, Instrumentation amplifier, Comparator, Schmitt trigger.

UNIT III *Text book -4* **(12)**

Digital Electronics: Number systems: Decimal, Binary Octal, Hexa - decimal number systems.
Boolean Algebra & Logic Gates: Boolean Logic Postulates. Basic logic gates, Universal Logic gates, Boolean expression simplification using K - Map Method up to 4 variables.

Combinational Logic Circuits: Definition, Combinational circuit designs Procedure, Design of Combinational Circuits: half - Adder, Full - adder, Half Sub tractor, Full Sub tractor, Decoder, Encoder, Multiplexer, DeMultiplexer.

UNIT IV *Text book -4* **(12)**

Sequential Logic Circuits: Definition, Flip - flops: SR, JK, T, D., Race around condition, Master - slave J.K.Flip - flop, Counters: Asynchronous versus synchronous counters, Design of ripple counters, shift registers.

UNIT V *Text book-5* **(12)**

Introduction: Introduction to microcontrollers, comparing microprocessors and microcontrollers, Architecture: Architecture of 8051, pin configuration of 8051 microcontroller, Input/output pins, ports and external memory, counters and timers, serial data Input / Output and interrupts.

TEXT BOOKS:

1. A.Sudhakar & S.P. Shyam Mohan - Circuit theory ,chapter- 1 of UNIT I , (TMH), 2002
2. B.P. Singh - Semiconductor devices & Circuits, chapter - 2 of UNIT -I(Dhanpati Rai)
3. D. Roy Chaudary & S. Jain - Linear integrated circuits for UNIT-2 (New - age international) 2nd Edition, 2003.
4. M.Morris mano - Digital Design by, PHI (for UNIT - 3,4) 2nd Edition,1999.
5. KennethJ.Ayala – The 8051 Microcontroller Architecture, Programming and Applications, Second Edition, Penram International Publishers, 2005.

REFERNCE BOOKS:

1. SALIVAHANA and Vallava Raj - Electronics devices and circuits TMH.
2. Milma & Halkies - Integrated Electronics,TMH
3. A. Anand Kumar- Switching Theory and Logic Design PHI,2010

***WEB REFERENCES*:**

- *www.ece.umd.edu/class/enee204.../LectureNOtes/LectureMain.htm*
- *http://nptel.iitm.ac.in/course.php?brach=Ece*
- *www.technologystudent.com/elecl/opamp1.htm*
- *http://www.ece.ubc.ca/~saifz/eece256.htm*

ME 254	BASIC MANUFACTURING PROCESS LAB	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

1. Students to know the working of lathe machine tool.
2. Students to know preparation of moulding sand and making of moulds of different shapes and sizes.
3. Students to know the cavities, and generating different shapes of moulds
4. Students to know the making of a pattern which is used in mould
5. Students to know the different types of fitting with metal plates

COURSE OUTCOMES:

a. Implementation of techniques and methods for performing different lathe operations, fitting operations and producing castings of different shapes.

Any 8 Experiments to be done from the following

PATTERN MAKING : Solid pattern , Split pattern .

MOULDING : Stepped cone pulley, Hand wheel, Bush.

FITTING : Six Standard Exercises

TURNING: Plain, Step and Taper turning, Right-hand and Left-hand threads, Eccentric turning, Knurling and contour turning.

LEARNING RESOURCES

REFERENCE BOOKS:

Kannaiah P. & Narayana K. C., "Manual on Work Shop Practice", Scitech Publications, Chennai

ME 255	COMPUTER APPLICATIONS IN MECHANICAL ENGINEERING LAB	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

1. The Lab helps the students to gain knowledge and skills needed for writing to use the C-code for applications in an mechanical engineering context.

COURSE OUTCOMES:

a. *Able to write programmes for mechanical engineering applications.*
b. *Abe to know the graphic commands and the students shall be in a position to write code for simulation of mechanisms.*
c. *Able to use software package like TORA to obtain results for operation research applications.*

Note : Develop programs for the following problems using C- language

SIMULATION EXERCISE: [Any TWO]

Hart Mechanism
Paucellier Mechanism Robert Mechanism
Scott Russel Mechanism Watt Mechanism
Pantograph Mechanism Four Bar Mechanism
Slider Crank Mechanism Tchibicheff Mechanism

COMPUTER APPLICATIONS: [ANY FIVE]

Numerical Methods
Differential Equation solution
Gauss elimination: General Matrix and skyline. Two dimensional stress analysis

Cylinder subjected to internal pressure.
1. D Heat Transfer (conduction)
2. D Heat Transfer (conduction)

O.R. applications like L.P., Queing Theory, CPM, PERT etc..

APPLICATIONS PACKAGES: [ANY ONE]

Simple packages for Fluid flow like fluent, Star CD etc., O.R. Packages like TORA, LINDO, PRIMAERA, etc.

Any application package in Mechanical Engineering.

ME 256	BASIC ELECTRICAL AND ELECTRONICS LAB	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

ELECTRICAL LAB

1. The students are trained in starting and conducting a performance test on DC motor
2. The student is trained in starting the DC motor and control its speed.
3. The student is trained for conducting performance tests on DC generator.
4. To study the Speed control of stepper motor
5. To study the Temperature control using controllers.

ELECTRONICS LAB

1. To study the characteristics of Diodes and Transistors
2. To study the functioning of logical gates, universal gates and Combination Circuits
3. To verify the various flip-flop Conversions (JK & D)

COURSE OUTCOMES:

ELECTRICAL LAB

Upon completion of this course, students should be able to:

g. Student will be able to understand, how to start a DC motor and how to control the speed of DC motor.
h. Students will have hands on practice in measuring various parameter and understanding the concepts in the operation of DC motor, DC generator,
i. Student will be able to analyze the factors that influence various processes in a DC machinery
j. Knows the Speed & Temperature control of stepper motor using controllers.
k. Knows the Temperature control using controllers.

ELECTRONICS LAB

By the end of course the student is exposed to analysis and design of

a. By the end of course the student is exposed to analysis and design of various circuit elements and circuit designs.
b. Student should understand the outcomes of digital circuits and design.

Note: Minimum FIVE Experiments from both Electrical & Electronics Streams should be performed.

Electrical Engineering

1. Verification of KCL / KVL

2. OCC of a DC Shunt Generator

3. Load Test on DC Shunt Generator
4. Speed Control of DC Shunt Motor
5. Swin burn Test
6. Speed control of stepper motor using Micro controller 8051
7. Temperature control using Micro controller 8051

Electronics Engineering

1. VI characteristics of PN junction diode
2. VI characteristics of Zener diode
3. Common emitter configurations (BJT)
4. Characteristics of JFET
5. Logic gates using universal gate (NAND gate)
6. Combinational Circuits (half adder, full adder, half subtractor)
7. Verification of Flip-Flop (JK & D etc.,)
8. Code converters (Gray to Binary & Binary to Gray)

III YEAR

ME 301	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To help students appreciate the essentials of morals, values and ethics
2. To facilitate the development of a Holistic perspective of engineering ethics.
3. To introduce the Ethical concepts that are relevant to resolving Moral issues in Engineering and to impart reasoning needed to apply ethical concepts to Engineering decisions
4. To understand importance of safety and risk.
5. To enable to know rules and regulations of various engineering practices

COURSE OUTCOMES:

a. Able to comprehend a specific set of behaviors and values the professional must know and must abide by, including confidentiality, accuracy and integrity.
b. Strive to achieve the highest quality, effectiveness and dignity in professional work.
c. Able to know about ethical theories and the role of engineer as an experimenters
d. Protect the safety, health and welfare of the public and speak out against abuses in these areas affecting the public interest.
e. Know and respect existing laws pertaining to professional work.

UNIT I **(12)**

Morals, Values and Ethics – Self-Confidence – Character- Valuing Time – Courage - Honesty– Caring – Sharing-Self respect – Respect for Others – Spirituality-Living Peacefully.

Integrity- Commitment – Empathy - Work Ethics - Service Learning – Stress management-Civic Virtue –Co-operation.

UNIT II **(12)**

Scope and aims of Engineering Ethics-Senses of 'Engineering Ethics' – Variety of Moral Issues – Types of Inquiry – Engineering Ethics and Philosophy

Moral Dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory –Criteria for a profession-Multiple Motives-Models of Professional Roles.

UNIT III **(12)**

Moral reasoning and Ethical Theories-Virtue Ethics- Utilitarianism-Duty ethics-Right ethics-Self interest, Customs and Religion -Uses of Ethical Theories-Testing of Ethical Theories

Engineering as experimentation – Similarities to Standard Experiments-Contrasts with Standard Experiments-Engineers as Responsible Experimenters – A Balanced Outlook on Law – Problems with Law in engineering- The Challenger Case Study.

UNIT IV **(12)**

Safety and Risk – Assessment of safety and risk – Risk benefit analysis and reducing risk –Testing for safety The Three Mile Island and Chernobyl case studies and safe exit.
Collegiality and loyalty – Respect for authority – Collective bargaining – Confidentiality – Conflicts of interest – Occupational crime — Intellectual property rights (IPR) – Discrimination.

UNIT V **(12)**

Professional rights – Employee rights-Whistle blowing-discrimination-Multinational corporations – Environmental ethics – Computer ethics – Weapons development.
Engineers as managers – Consulting engineers – Engineers as expert witnesses and advisors – Moral leadership – codes of ethics-role and limitations of codes-Sample code of ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronic and telecommunication engineers (IETE), India, etc.

TEXT BOOKS:

1. Mkie Martin and Roland Schinzinger, "Ethics in Engineering", McGraw – Hill, New Jersey, 2004 (Indian Reprint)
2. Govindarajan M, Natarajan S, Senthil Kumar V.S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, 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)

WEB REFERENCES:

- www.springer.com › ... › Applied Ethics & Social Responsibility
- www.onlineethics.org/
- courses.soe.ucsc.edu/.../engineering-ethics-cases.pdf?... - United States

ME 302	DESIGN OF MACHINE ELEMENTS	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

The following are the objectives of the course:

1. This course is meant to formulate a practical problem and use the engineering tools and engineering sciences to solve it.
2. To illustrate the integration of design principles, materials selection and fundamentals of design concepts.
3. The loading conditions and accompanied stress and strain, forces, moments, torque.
4. To develop ability to analyze, design and/or select machine elements such as screws, fasteners, threaded joints under static conditions
5. Ability to analyze design of riveted and welded joints

COURSE OUTCOMES:

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

a. This course provides the knowledge to design simple mechanical components subjected to static loads and their failure and concept of factor of safety in design of simple mechanical parts
b. To apply knowledge in designing mechanical components subjected to stress concentration combined static & variable loads by applying Soderberg, Goodman & Gerber's Equations.
c. The student will be able to design power screws like screw jack subjected to various stresses.
d. To design riveted joints, including boiler joint and lozenge joint subjected to internal pressure, axial loads & eccentric loads.
e. Develop and use appropriate analytical models and software for design, modeling, and analysis.

UNIT I (12)

Basics: Basic procedure of machine design, requirements and design of machine elements, traditional design methods, Design synthesis, use of standards in design. manufacturing considerations in machine design, preferred numbers and significance.
Materials & their Properties: Mechanical properties of materials, Common engineering materials and their properties.

UNIT II (12)

Design for Static Strength: Simple Stresses, Combined stresses, Torsional and Bending stresses - stress strain relation, various theories of failure, Factor of safety and its importance in design.

Stress concentration: Stress concentration, stress concentration factors, reduction of stress concentration.

UNIT III (12)

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 finite and infinite life, cumulative damage in fatigue, Soderberg and Goodman lines, modified Goodman diagrams, Gerber equation, fatigue design under combined stresses, impact stresses

Power Screws: Types - Mechanics of power screws, efficiency, Design of Screw Jack.

UNIT IV (12)

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.

Cotter Joints: Sleeve and Socket & Spigot cotter joints, Gib & cotter joint and turnbuckle.

UNIT V (12)

Riveted joints: Boiler Joints & Lozenge Joint, Design of joints under eccentric loading.

Welded joints: Eccentrically loaded welded joints

LEARNING RESOURCES

TEXT BOOKS:

1. Design of Machine Elements by V.B. Bhandari, Tata McGraw Hill, 3rd Edition, 2010.
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 ,PHI Ltd,2005.

HAND BOOKS TO BE ALLOWED IN SEMESTER EXAMINATION:

1. Design data book, P.S.G. College of Technology, Coimbatore
2. Design data book, Mahadevan & Balaveera Reddy - CBS Publications, 1984.

COURSE RELEVANT WEBSITES:

- *http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv077-Page1.htm*
- *http://www.fastenal.com/content/feds/pdf/Article%20-%20Bolted%20Joint%20Design.pdf*
- *http://people.rit.edu/megite Lec%203%20Fatigue %20Failure% 2003100 4_ for_students.ppt*
- *http://engineershandbook.com/Tables/materials.htm*
- *www.nptel.iitm.ac.in/video.*

ME 303	METAL CUTTING & MACHINE TOOLS	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. *Understand the basic motions of tool and machine and the factors which dictate the machining process.*
2. *To provide the fundamental knowledge regarding the working principle, specifications, parts and various operations performed various tools.*
3. *To provide basic information regarding the way of formation of chips, deformation of work piece, generation of temperature.*
4. *Establish the relation between shear angle and chip thickness ratio, stress and strain in the chip, and cutting forces.*
5. *To provide information regarding the cutting tool materials and their application to different metals in metal cutting.*

COURSE OUTCOMES:

a. *Know the importance of basic parameters cutting speed, feed and depth of cut which dictates the machining process.*
b. *Gain the knowledge of operating the machines and their mechanisms.*
c. *Learn the various forces acting on machining process which provides the basic information regarding the rigidity, capacity of the machining process.*
d. *To learn the best practices of milling operations*
e. *To get familiar with the nomenclature of tool and the parameters in the selection of tools*

UNIT I **(12)**

Machining Processes and Machine Tools: Introduction, Primary and Auxiliary Motions in Machine Tools, Parameters defining working motions of a Machine Tool.

Lathe : Constructional details, specifications, classification of lathes. Lathe accessories - various work holding devices

Lathe Mechanisms: Spindle speed Mechanisms in Belt driven and All Geared Head stock lathe, Apron and Half-nut mechanisms.. Lathe operations including taper turning and thread cutting and related problems.

UNIT II **(12)**

Drilling Machines: Types and specifications, spindle feed mechanism, drilling operations, drilling time. Constructional details, types of shapers

Shaping and Planning: Constructional details, types of Constructional details, types planers, specifications, Quick Return Mechanism in shapers and planers, automatic feed mechanisms shapers and planers.

UNIT III **(12)**

Grinding Machines: Types of grindingmachines: constructional details cylindrical, centerless and surface grinding machines. Tool and cutter grinding machines.

Wheel materials, Selection and specification of grinding wheels, Truing and Dressing of grinding wheels, Surface Finishing Operations: Honing and Lapping operations

UNIT IV (12)

Milling Machines: Working Principle, Size and Specification, Up and Down Milling, Types of milling machines, Description and working of Universal Milling machine.
Milling operations, Milling cutters, Indexing methods and Indexing Head, related problems.

UNIT V (12)

Theory of Metal Cutting: Introduction, Basic elements of machining, 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, Heat Generation and temperature distribution in metal cutting, cutting fluids- types and required characteristics. Cutting Tool Materials.Requirements of Tool materials and types, economics of machining.

LEARNING RESOURCES

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Materials and Processes in Manufacturing by E.Paul De Garmo, J.T.Black and Ronald A.Kohser , John Wiley & Sons, 2003.
2. Manufacturing Technology , Vol II by PN.Rao, 2nd Edition ,MGH , 2009.
3. Manufacturing Science by A. Ghosh & A.K.Mallik , Affiliated East-West Press (P) Ltd., New Delhi ,Re Print 1998.

WEB RESOURCES:

- www.hgfarley.com
- www.kennametal.com/ - United States
- www.mini-lathe.com/links.htm,machinedesign.com/.../designer-s-guidetometalcutting-machinery-0608-
- www.metalwebnews.com/wc.html
- www.britannica.com/EBchecked/topic/463000/planer
- www.americanmachinist.com
- www.machinetools.net.tw/parts/taiwan_voltage_regulator.htm

ME 304	IC ENGINES & GAS TURBINES	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

1. To impart the knowledge of engine components, working principles of IC engines, auxiliary systems.
2. To able the understanding of combustion aspects of SI and CI engines in addition to the methods of improving performance.
3. To expose to the latest developments in the field of IC engines like MPFI ,CRDI etc.
4. To make the student about the working of Reciprocating and Rotary Compressors.
5. To make the student about various types of Gas turbines their working principles and basic principles of Jet and Rocket propulsion systems.

COURSE OUTCOMES:

a. The students are expected to understand the various components, principle of operation, working of different types of I.C engines.
b. Able to know the variables affecting the performance of IC engines and methods to improve the performance.
c. Able to understand the Working of different types of compressors.
d. Able to know the classification of Gas turbines and working principles of Gas turbines and methods to improve the performance of the plant.
e. Also able to know the working principles of various jet propulsion systems like Turbo jet, Turbo prop, Ramjet and Pulse jet and Rocket propulsions systems.

UNIT I **(12)**

I.C.Engines: Introduction, Engine nomenclature, Classification of I.C.engines, Working principles of S.I. and C.I. Engines (both 4 stroke and 2-stroke)-Valve Timing and Port Timing diagrams - Differences between S.I. & C. I. and 2 Stroke & 4 stroke engines.

Fuel Supply Systems: S.I. Engines- Chemically correct air-fuel ratio, Air fuel Mixture requirements, Carburetion, Simple float type carburetor, Fuel injection System for SI engines, MPFI.

C.I.Engines- Air- fuel requirements, fuel injection systems, Electronic injection system,CRDI.

UNIT II **(12)**

Combustion Processes: S.I.Engines-Normal combustion, abnormal combustion Knock rating and Octane number.

C.I.Engines- Ignition delay, combustion knock in C.I. engines, Knock rating and Cetane number.

Testing of I.C.Engines: Indicator diagram, evaluation of Indicated Power, Brake power, Fuel consumption, SFC, Mechanical & Thermal efficiencies, Mean Effective Pressure, air-fuel ratio.

UNIT III (12)

Performance of I.C Engines: Heat balance, Engine performance Curves, Variables affecting engine performance for both S.I. & C.I.Engines.

Reciprocating Air Compressors: Classification, Operation, Effect of clearance volume, pressure ratio, volumetric efficiency, power input, single-Stage and Multi-stage compressors, Effect of inter-cooling, optimum intermediate pressure in a two-stage compressor.

UNIT IV (12)

Rotary Compressors: Introduction, Types and their applications, principles of working, static and total head values

Centrifugal compressor- velocity Vector diagrams, pressure coefficient, prewhirl.

Axial flow compressor: Axial flow compressor Polytropic efficiency, Surging, Choking and Stalling, centrifugal Compressor versus axial flow compressor.

UNIT V (12)

Gas Turbines: Closed and Open cycle gas turbines, analysis of closed cycle gas turbine, efficiencies of Compressor and turbine, cycles with inter-cooling, reheat and regeneration.

Jet & Rocket Propulsion: Basic principles of Jet propulsion – specific thrust, Propulsive efficiency and overall thermal efficiency of a jet engine, Principle of Rocket propulsion.

LEARNING RESOURCES:

TEXT BOOKS:

1. I.C. Engines - V.Ganesan - T.M.H., New Delhi, 3rd Edition
2. Treatise on Heat Engineering-V.P.Vasandani and D.S.Kumar, Metropolitan Book co, New Delhi, 4th Edition.
3. Thermal Engineering -Rajput, Laxmi Publ, New Delhi , 2012.
4. Thermal Science and Engineering- D.S.kumar, S.K.Kataria Publ, New Delhi 2010.

REFERENCE BOOKS:

1. Fundamentals of I.C.Engines - H.N. Gupta, PHI, New Delhi, 2009
2. A Course in I.C. Engines - M.L.Mathur & R.P.Sharma - Dhanpat Rai & Sons- New Delhi, 2010.
3. Gas Turbine Theory - Cohen, Rogers and Sarvanamuttu, 5th Edition.

WEB RESOURCES:

- http://autoclub.rso.siuc.edu/frange.html
- http://www.howstuffworks.com/engine1.htm
- http://inventors.about.com/library/inventors/blinternalcombustion.htm
- http://www.animatedengines.com/

ME 305	OPERATION RESEARCH	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

a. Recognize the importance and value of Operations Research and linear programming in solving practical problems in industry
b. Interpret the transportation models' solutions and infer solutions to the real-world problems.
c. Recognize and solve assignment and dynamic programming problems.
d. Gain knowledge in fundamentals of queuing theory and theory of games.
e. To Know when simulation and dynamic programming can be applied in real world problems

UNIT I **(12)**

Linear Programming: Definition and Scope of Operations Research, Mathematical formulation of the problem, graphical method, Simplex method, artificial basis technique, duality, dual Simplex method. Degeneracy, alternative optima, unbounded solution, infeasible solution.

UNIT II **(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.

UNIT III **(12)**

Assignment Problem: One-to-one assignment problem, optimal solution, unbalanced assignment matrix. Traveling salesman problem.

Dynamic programming: Introduction, Characteristics of D.P. model, the recursive equation approach, solution of an L.P. by D.P.

UNIT IV (12)

Queuing Theory: Queuing systems and their characteristics. Analysis of Markovian chains, Transition diagram, M/M/1: FCFS/ ∞ / ∞ model.

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

UNIT V (12)

Simulation: Definition and applications. Mante Carlo simulation. Random numbers and random number generation: Application problems in queuing and inventory.

Decision Theory: Introduction, decision under certainty, Decision under risk- expected value criterion, expected value combined with variance criterion, decision under uncertainty, decision tree.

TEXT BOOKS:

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

REFERENCES:

1. Introduction to Operations Research - Phillips, Ravindran, James Soldberg Wiley 1976.
2. Operations Research - H.A. Taha, Pearson, 7th Edition, June 2002.
3. Operations Research - Gupta and Hira, S.Chand, 2008.

WEB REFERENCES:

- http://www2.informs.org/Resources/
- http://www.mit.edu/~orc/
- http://www.ieor.columbia.edu/
- http://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.htm
- http://www.wolfram.com/solutions/OperationsResearch/

ME 306	DYNAMICS OF MACHINES & VIBRATIONS	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

1. Students will be able to understand basic concepts of forces involved in mechanism and estimate the inertia forces and torques.
2. The student is able to learn about the various types of governors and estimate the equilibrium speeds.
3. The student is able to learn about the balancing of rotating masses located in the same and different planes.
4. The student is able to learn about the gyroscopic effects on rotating shaft, ships and stability of two wheelers when negotiating curved path.
5. The student is able to learn undamped and damped free and forced vibrations and how to determine the natural frequency of the single degree of freedom system.
6. The student is able to learn about the vibration measuring instruments that are useful in present life.
7. The student is able to learn about the two degrees of freedom systems and how to draw the mode shapes of the system.

COURSE OUTCOMES:

The Students are able to know

a. Unbalance in rotating machinery
b. Estimation of Inertia forces in a crank-slider mechanism
c. State of balance of typical multi-cylinder engines
d. Sources, effects, types of vibration and elimination.
e. Dynamic stability of structures

UNIT I **(12)**

Dynamic Force Analysis: Introduction, D'Alembert's Principle,
Equivalent Offset Inertia Force, Dynamic Analysis of Slider - Crankmechanism (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 II **(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 III **(12)**

Fundamentals of Vibration:- Introduction, Definitions, Vector method of representing Harmonic Motions, Addition of two simple Harmonic motion of the same frequency.

Undamped Free Vibrations of Single Degree of Freedom Systems:-Introduction, Derivations of differential equations, solution of differential equation, Torsional vibrations, Equivalent stiffness of spring combinations, Energy method.

UNIT IV **(12)**

Damped Free Vibrations of Single Degree of Freedom Systems:-Introduction, Different types of damping, Free vibrations with viscous damping, Logarithmic Decrement, Viscous dampers, Coulomb damping,

Forced Vibrations of Single Degree of Freedom Systems:-Introduction, Forced vibrations with constant Harmonic excitation, Forced vibration with rotating and reciprocating unbalance, forced vibrations due to excitation of the support, Vibration, isolation and transmissibility.

UNIT V **(12)**

Critical speed of a light shaft having a single disc without damping, critical speed of a light shaft having a single disc with damping, Vibration measuring instruments

Two Degrees of Freedom Systems: Introduction, Principal modes of vibration, undamped dynamic vibration absorber.

LEARNING RESOURCES

TEXT BOOKS:

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.

RFEERENCE BOOKS:

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 Print 2000

WEB REFERENCES:

- Machine Dynamics by Prof. Amitabha Ghosh, IITK, Kanpur http://nptel.iitm.ac.in/video.php?subjectId=112104114
- 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 351	MACHINESHOP PRACTICE	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

1. Students will be able to understand the basic machining Process and operation of the machine and its controls
2. Students will be able to understand the speeds & feed mechanism of different types of machine tools.
3. To provide the knowledge regarding primary & auxiliary motions of machine tools
4. To provide the basic knowledge regarding the tool geometry and its significance in machinery operations.
5. To provide the basic knowledge w.r.t single point & multi point cutting tools.

COURSE OUTCOMES:

a. Students can themselves operate on the machine and produce the given components comfortably.
b. Students should be well aware about the range of speeds, feed and depth of cut while operating various mechanisms.
c. Students distinguish various machine tool operations.
d. Students learn chip formation process, chip removal processes.
e. Students identify the difference between roughing and finishing operations and machining conditions related to these operations.

Any 8 Experiments to be performed

TURNING:
Multi-start threading, Drilling, Boring and Internal threading

DRILLING & TAPPING:
Drilling and Tapping of Different threads

MILLING:
Key-way, Spur and Helical Gear Milling, Gear Hobbing.

SHAPING:
At least three models involving production of flat surface, Stepped surface, Cutting dovetail and rectangular grooves.

PLANING AND SLOTTING:
Working on Planing and Slotting Machines

GRINDING:
At least one model on surface grinder, cylindrical grinder or tool and cutter grinder.

ME 352	FUELS & IC ENGINES LAB	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

1. To provide practical approach of determining thermo-physical properties of some substances, which are essential in smooth working of mechanisms and machines.
2. Also presenting Engine constructional and working details to evaluate the performance of automobile engines.

COURSE OUTCOMES:

a. The student can experimentally determine viscosity, calorific value, Flash and Fire points of fuels.
b. The Students will be able to conduct performance tests on both petrol and diesel engines.
c. The students will be able to do performance test on Reciprocating compressor and Blower.

Any **Ten** Experiments out of the following are to be performed:

1. Viscosity Measurement using Redwood viscometer No. I or No. II
2. Viscosity Measurement using Saybolt viscometer
3. Calorific value of gas using Junker's gas calorimeter.
4. Measurement of flash point using Pensky Martin's and Abel's apparatus.
5. Measurement of flash and fire points using Cleveland's apparatus.
6. Valve timing and port timing diagrams.
7. Air compressor - To determine Volumetric and Isothermal efficiencies.
8. Blower test Rig. - To determine Overall efficiency.
9. Single cylinder Diesel engine - Load test.
10. Twin cylinder Diesel engine - Load test and Heat Balance test.
11. Multi cylinder Petrol engine - Load Test, and Morse test.
12. Single cylinder Diesel engine - variable compression ratio test.

ME 353	MODELING LAB	L	T	P	M	C
		-	-	3	100	2

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:

a. The students will be able to model the given 2D and 3D components, Assemblies etc.
b. Has ability to layout an efficient production area and industrial facility using Computer-Aided Design (CAD) software.

3D modelling using any of the modelling packages like CATIA, Pro/ ENGINEER, Uni-Graphics, Solid Works, Ideas, AutoDesk Inventor etc.

List of Modules to be Covered:

SKETCHER

PART MODELLING

WIREFRAME & SURFACE MODELING ASSEMBLY MODELLING

DRAFTING

with examples of Assembly drawings.

Parts and Assemblies can be choosen from

1) *"Machine Drawing" by K. L. Narayana, P. Kannaiah, K. Venkata Reddy , New Age International , 2007.*

ME 307	MANUFACTURING ENGINEERING	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To develop knowledge in design considerations, principles and related devices used in Jigs and Fixtures
2. To provide knowledge in manufacturing of gears and threads
3. To develop knowledge in principles of operation, equipment and applications of unconventional machining Processes.
4. To provide knowledge of various types of press working tools and related calculations
5. To develop knowledge in COMPUTER AIDED INSPECTION equipment such as CMM (Coordinate Measuring Machines) and Machine vision techniques

COURSE OUTCOMES:

a. Ability to identify the functions of location,clamping devices and applications of JIGS & FIXTURES
b. Able to know methods of manufacturing various types of gears,principles of gear generation and finishing methods
c. Able to visualize screw threads production methods
d. Able to know the principles of operation, equipment and applications of UNCONVENTIONAL MACHINING PROCESSES
e. Able to understand PRESS WORKING TOOLS major components,types of drawing dies, bending dies and related calculations.
f. Able to know types of CMM (Coordinate Measuring Machines) and its related accessories
g. Able to know Machine vision principle and its related equipment and applications

UNIT I **(12)**

Jigs & Fixtures: Introduction, design considerations in jigs & fixtures. The principle of six point location, locating pins, Clamping and clamping devices.

A few examples of drilling jigs like box type, template jig, indexing jig, fixtures - Lathe, milling

UNIT II **(12)**

Gear Manufacturing: Introduction to various gear manufacturing methods, gear shaping, gear hobbing, bevel gear generation – principles and methods, gear finishing methods.

Thread Manufacturing Processes: introduction to thread manufacturing techniques, thread chasing on turret lathe, die the threading and tapping, Thread rolling, thread milling, and thread grinding.

UNIT III **(12)**

Unconventional Machining Processes: Introduction, principles of operation, equipment and applications of AJM, USM, WJM, EDM, ECM, CHM, EBM, LBM and PAM.

UNIT IV **(12)**

Press Working Tools: Major components of a press, shear action in die cutting operation, Blanking and Punching operations, clearance and shear as applied to punching / blanking operations, centre of pressure and its calculation, scrap strip layout for blanking, simple related problems

Types of dies - compound die, combination die, progressive die. Drawing die: Calculation of blank size, number of draws, percentage reduction, radius on punch and die, total drawing force.Bending die: Bending methods, spring back, bending allowance, bending force.

UNIT V **(12)**

Computer Aided Inspection: Types of CMM (Coordinate Measuring Machines), CMM construction, CMM operation and programming, CMM software, Flexible inspection systems, CMM applications and benefits.

Machine vision: principle and introduction to stages in machine vision, image acquisition and digitization, image processing and analysis, interpretation, machine vision applications.

LEARNING RESOURCES

TEXT BOOKS:

1. *Production Engineering by P.C. Sharma, S.Chand&Co , 2007.*
2. *Manufacturing Science by A. Ghosh &A.K.Mallik , Affiliated East-West Press (P) Ltd., New Delhi ,Re Print 1998.*

REFERENCE BOOKS:

1. *Manufacturing Engineering & Technology by Kalpak Jain, PHI , 5th Edition , 2005.*
2. *Engg. Metrology - R.K.Jain , Khanna publishers , 20th Edition , 2012.*
3. *Automation, production systems & CIM by M.P.Groover, PHI , 2007.*

WEB REFERENCES

- *http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Manuf%20Proc%20II/New_index1.html*
- *http://aglasem.com/resources/reports/pdf/non%20conventional.pdf*
- *http://www.123eng.com/seminar/GEAR%20MFG..pdf*
- *www6.conestogac.on.ca/~ffulkerson/J&F%20Notes.pdf*
- *http://www.brownandsharpe.com/pdf/intro_to_cm.pdf*

ME 308	DESIGN OF TRANSMISSION ELEMENTS	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

To Provide Knowledge on

1. Shafts with various types of Loading arrangements for both Strength and Rigidity aspects
2. Journal and Anti friction Bearings, types, their construction, lubrication and selection procedures.
3. Flexible drives like Flat & V- belts and chain drives, types, construction and selection
4. Gears like Spur and Helical their materials used, Design of strength and Gear Forces
5. Gears like Bevel and worm gears, materials used, force analysis of gears and their wear strength.

COURSE OUTCOMES:

a. This course provides the knowledge to design simple mechanical components subjected to static loads and their failure and concept of factor of safety in design of simple mechanical parts
b. To apply knowledge in designing mechanical components subjected to stress concentration combined static & variable loads by applying Soderberg, Goodman & Gerber's Equations.
c. The student will be able to design power screws like screw jack subjected to various stresses.
d. To design riveted joints, including boiler joint and lozenge joint subjected to internal pressure, axial loads & eccentric loads.
e. Develop and use appropriate analytical models and software for design, modeling, and analysis

UNIT I **(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 II **(12)**

Bearings and Lubrication: Lubrication, Types of lubrications, types of lubricants, properties of lubricants, 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

UNIT III **(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 IV **(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.

UNIT V **(12)**

Bevel Gears: Terminology, force analysis, Beam Strength of bevel gears, wear strength. Lewis Equation, Effective load on gear tooth

Worm Gears: Terminology, Force analysis, Strength rating of worm gears, Wear rating of worm gears, Thermal Considerations.

LEARNING RESOURCES

TEXT BOOKS:

1. Design of Machine Elements by V.B.Bhandari, Tata McGraw Hill, 3rd Edition 2010.
2. Machine Design by P.C. Sharma & D.K. Agarwal., S.K. Kataria & Sons, 1997.
3. Design of Machine Elements by C.S. Sharma & K. Purohit ,PHI Ltd.

HAND BOOKS TO BE ALLOWED IN SEMESTER EXAMINATION:

1. Design data book, P.S.G. College of Technology, Coimbatore
2. Design data book, Mahadevan & Balaveera Reddy - CBS Publications , 1984.

WEB REFERENCES

- *http://www.uni.edu/~rao/Md-17%20Shaft%20Design.pdf*
- *http://www.uni.edu/~rao/Md-15%20Keys%20and%20Couplings.pdf*
- *http://etidweb.tamu.edu/ftp/ENTC463/Notes/ENTC463Key%20and%20Coupling.pdf*
- *science.howstuffworks.com/transport/engines.../bearing1.htm*
- *http://www.fi.edu/time/Journey/Time/Escapements/gearint.html*

ME 309	HEAT TRANSFER	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

1. To enable the student to distinguish among the three modes.
2. To enable the student to prepare mathematical model of the problem with appropriate boundary conditions.
3. To enable the student to learn the basics of convective heat transfer.
4. To enable the student to design thermal equipment.
5. To enable the student to utilize analogies to solve heat transfer Problems.
6. To enable the students to estimate the radiation heat transfer between the bodies.

COURSE OUTCOMES:

a. Analyze and design various methods of heat transfer for the bodies undergoing heat exchange using fundamental concepts of Conduction, Convection and Radiation.
b. To estimate heat loss from the system to the surroundings at an interval of time during its working eg. IC Engines, Turbines etc.
c. Apply correlations to compute heat loss due to convection for practical applications.
d. Design heat transfer equipment to prevent failures of components due to poor heat dissipation.
e. Estimation of radiation heat transfer between bodies

UNIT I **(12)**

Introduction: Basic Modes of heat transfer- Conduction, Convection and Radiation definitions, their mechanisms and their governing laws-Steady state Heat Conduction- General conduction equation in Cartesian and Cylindrical coordinates-Initial and Boundary conditions

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, critical insulation thickness, uniform heat generation in slabs.

UNIT II **(12)**

Extended Surfaces: Types, Applications, Fin materials, Heat transfer from fins with uniform cross section, Fin efficiency and Effectiveness.

Transient Heat Conduction: (One dimensional only) - Lumped heat capacity systems –plane wall, cylinder and sphere

UNIT III **(12)**

Forced Convection: External Flows: Introduction, Principles of convection-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 IV (12)

Natural Convection: Mechanism of natural convection, Velocity and Temperature profiles over a vertical heated plate, Correlations for vertical plates, horizontal plates, vertical and horizontal cylinders –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 V (12)

Radiation: Basic Concepts and definitions, Absorptivity, Reflectivity, Transmissivity, Concept of Black body, Intensity of radiation and Solid angle, Lambers Cosine law, Laws of Radiation- Planck's distribution law, Wein's displacement law, Stefan Boltzmann's law, Radiation from non black surface-emissivity, Kirchoff's law.

Radiant Heat Transfer: Radiative heat exchange between Black surfaces –Radiation shape factor, Radiation heat exchange between Gray bodies –Two small gray bodies, two infinite parallel surfaces, concentric cylinders/spheres , Small body enclosed and Large enclosure- **(Only Problems with formulae derivations not required)** Electrical analogy, Radiation shields.

LEARNING RESOURCES

TEXT BOOKS:

1. Heat Transfer - Cengel and Boles, TMH, New Delhi , 2008.
2. Heat and Mass Transfer - Sachdeva, New Age India, New Delhi, 2009.
3. Heat Transfer-Rajput, Laxmi Publ, New Delhi,2011.

REFERENCE BOOKS:

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

WEB REFERENCES:

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

NOTE: Heat and Mass Transfer Data Book by Kothandaraman and Subramanian to be allowed in Semester Examination.

ME 310	FINITE ELEMENT ANALYSIS	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

1. To furnish information on advanced strength of materials and to Introduce the basic concepts, background and methodology of FEM.
2. To select suitable elements for Finite element modeling, deriving the necessary elemental matrices and for applying the principles to various mechanical systems.
3. To learn the application of FEM to various structural problems Incorporating temperature and boundary conditions.
4. To utilize the FEM for various two dimensional Axi symmetric problems.
5. To derive the element mass matrices which help to predict dynamic behaviour of the structure.

COURSE OUTCOMES:

a. Create new solutions for the existing problems using FEA approaches.
b. Derive element stiffness and mass matrix equations for various structural systems.
c. To know the usage of different elements for different structures.
d. Determine engineering design quantities (deformation, force, strain, stress) for bar, truss, beam and frame structures and under different loading conditions.
e. Apply the steps in FEM solution to a variety of physical systems and Use FEA to do projects.

UNIT I **(12)**

Introduction:

Objectives and Methods of Engineering Analysis ,FDM Vs FEM ,Rayleigh – Ritz Method , Weighted Residual Methods.

Introduction to Finite Element Method ,FEM Advantages , Disadvantages , FEM Applications , Stresses and Equilibrium. Strain Displacement relations. Stress - Strain relations for Plane stress and Plane Strain, FEM Procedure

UNIT II **(12)**

One Dimensional Elements: Finite Element Modeling, coordinates and shape functions, Potential Energy approach - Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Temperature Effects, Problems related to simple Axially loaded members.

Analysis of Trusses: Element stiffness matrix, Stress Calculations, Problems limited to truss with three members only.

UNIT III **(12)**

Analysis of Beams: Derivation of Element stiffness matrix for two node, two degrees of freedom per node, Beam element and Simple Problems.

Analysis of Frames: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses.

UNIT IV (12)

Two Dimensional Elements: Finite element modelling of two dimensional stress analysis with constant strain triangles (CST) and treatment of boundary conditions.
Finite element modelling of Axisymmetric solids subjected to Axisymmetric loading with triangular elements.

UNIT V (12)

Concepts of Iso parametric, Super parametric and Sub parametric Elements, Stiffness and Force Matrices for Two dimensional four noded Quadrilateral element and numerical Integration by using Gaussian Quadrature.

Dynamic Analysis: Formulation of finite element model, element matrices for one dimensional element, evaluation of Eigen values and Eigen vectors for a stepped bar by Characteristic Polynomial Technique..

LEARNING RESOURCES

TEXT BOOKS :

1. Introduction to Finite Elements in Engineering, Chandraputla, Ashok and Belegundu, PHI, 3rd edition, 2003.
2. The Finite Element Methods in Engineering, SS Rao, Pergamon, 5th Edition, 2011.

REFERENCES :

1. An Introduction to Finite Element Method, JN Reddy / Me Graw Hill, 2nd Edition, 1993.
2. Finite Element Methods: Basic concepts and applications, Alavala, Chennakesava.R, PHI, 2009.

WEB REFERENCES :

- Nptel.ac.in/courses/112104116
- www.colorado.edu/MCEN/MCEN4173

ME 311A	ELECTIVE I NANO TECHNOLOGY	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To provide the basics of nano concepts and nanostructures.
2. To give an idea of synthesis of nano materials.
3. To provide knowledge on characterization of nano materials.
4. To introduce to CNTs and applications.
5. To provide fundamentals on fabrication of miniaturized devices and sensors.
6. Nanotechnology is an advanced course deals with science and technology associated at nano scale. This course is a foundation to many novel techniques and design.

COURSE OUTCOMES:

a. To learrn nanoscale manufacturing techniques.
b. To analyze, design and utilization of nano materials.
c. Students can attain knowledge regarding the self-assembly and self-organization of nano-layers.
d. Apply methodologies to study the nano structures.
e. Students become professionally sound with regards to social responsibilities.

UNIT I **(12)**

Introduction to Nanotechnology: History of Nano Technology, Definition of Nanotechnology, Nanoscience and Nano Technology, Feynman predictions on Nano Technology, Moore's law. Nano Technology applications in various fields.

Nano Structures: Classification of Nanostructures- Zero dimensional-Nanoparticles, One Dimensional Nanowires, Two dimensional Nano structures-Thin films.

UNIT II **(12)**

Top-Down Nanofabrication: Definiton: **Top-Down fabrication methology-Deposition (or) Growing**-Physical Vapour deposition methods, Chemical Vapour deposition methods. **Lithography**-Photo Lithography, Soft lithography-Nano imprinting, **Etching**-Physical and Chemical Etching. **Material modification** –Methods.

Bottom-up Fabrication Methodology: Definition. Building block Fabrication- Physical fabrication approaches, Chemical Vapour growth (VLS Mechanism). Nano wires preparation, control of size and applications.

UNIT III **(12)**

Characterization of Nano Structures: Electron microscopy- SEM, TEM Scanning Probe Microscopy-STM, AFM, X-rays.

Self Assembly and Self Organization-Chemical Self assembly (SAMs), Physical self assembly-examples, Quantum dots applications. Longmuir-Blodgett films, layer-by-layer growth.

UNIT IV (12)

Special Nanomaterials: Fullerenes, Carbon Nanotubes (CNTs), Study of Structure of CNTs and Various methods of Synthesis of CNTs.
Applications of CNTs- Electronic, Optical and Mechanical properties, Advantages.

Nano Composites: Introduction to Nano materials and Nano composites, Synthesis and applications.

UNIT V (12)

MEMS and NEMS: Micro electromechanical systems-MEMs and Nano electromechanical systems-NEMs- Preparation and applications.
Mechanics at Nano Scale: Enhancement of mechanical properties with decreasing size, Nanomachines, Nano Fluidics.

TEXT BOOKS:

1. Introduction to Nanotechnology by Poole and Owens, Wiley (2003).
2. Nanostructures & Nanomaterials, Synthesis Properties and applications by Guozhong Cao. IPC London.
3. Hand Book of NanoTechnology Bharat Bhushan, Springer.

REFERENCES:

1. Nanoscale Science and Technology by Kelsall, Hamley, and Geoghegan, Wiley (2005).
2. Nanochemistry: A Chemical Approach to Nanomaterials, Ozin and Arsenault, RSC Publishing.
3. Introduction to Nanoscale Science and Technology by Di Ventra, Evoy, and Heflin, Kluwer Academic Publishers (2004).

WEB REFERENCES

- *http://www.evidenttech.com/applications*
- *www.fli-leibniz.de/~kboehm/Kinesin.html*
- *www.fbs.leeds.ac.uk/research/contractility/dynein/model-page.htm*
- *http://www.nccr-nano.org/nccr/research/modules/module_01*
- *http://www.nano.org.uk/Wheel.htm*
- *//www.cancer.gov/cancertopics/understandingcancer/nanodevices*
- *http://www.ethicsweb.ca/nanotechnology/*
- *http://www.foresight.org/*
- *The Center for Responsible nanotechnology: http://crnano.org/*
- *http://en.wikipedia.org/wiki/Stained_glass*
- *http://www.nanotech-now.com/columns/?article=255*

ME 311B	ELECTIVE I TRIBOLOGY	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To provide broad based understanding of the interdisciplinary subject 'tribology' and its technological significance
2. To understand the nature of engineering surfaces, their topography and learn about surface characterization techniques
3. To understand the genesis of friction, the theories/laws of sliding and rolling friction
4. To learn about consequences of wear, wear mechanisms, wear theories and analysis of wear problems
5. To learn about the principles of lubrication, lubrication regimes, theories of hydrodynamic Lubrication
6. Understanding the principles of bearing selection and bearing arrangement in machines.

COURSE OUTCOMES:

a. Students will be able to identify and describe the theories of friction and the factors affecting the coefficient of friction between contacting surfaces in relative motion.
b. Students will be able to identify wear mechanisms and show how to minimize wear for different interfacial conditions.
c. Students will be able to identify the lubrication modes such as hydrodynamic lubrication.
d. Students will be able to know requirements of bearing materials, Types of bearing materials
e. Students able to know various coating techniques.

UNIT I **(12)**

Tribology: Introduction, tribology in design and industry, economic considerations. Lubrication- Regimes of lubrication, Classification of contacts, lubrication theories.

Study of various parameters: Viscosity, flow of fluids, Viscosity and its variation - absolute and kinematic viscosity, Temperature variation-Numerical Problems. Different viscometers used.

UNIT II **(12)**

Wear: Types of wear, various factors affecting wear, simple theory of sliding wear, mechanism of sliding wear of metals, abrasive wear, materials of adhesive and abrasive wear situation, corrosive wear, surface fatigue wear situations, brittle fracture wear, wear of ceramics, wear measurement.

Friction : Introduction, laws of friction, sources of sliding friction, adhesion,ploughing, energy dissipation mechanisms, friction characteristics of metals, friction of non metals, friction of ceramic materials, rolling friction, source of rolling friction, stick slip

motion, measurement of friction.

UNIT III **(12)**

Lubricants and Lubrication Types: Types and properties of lubricants, testing methods, hydro dynamic lubrication, elasto-hydro dynamic lubrication, boundary lubrication, solid lubrication, hydrostatic lubrication.

Hydrostatic lubrication: Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing-Numerical problems.

UNIT IV **(12)**

Hydrodynamic Lubrication: Newton's Law of viscous forces, Flow through stationary parallel plates. Hagen's poiseuille's theory-Numerical problems, Concept of lightly loaded bearings, Petroff's equation, Numerical problems.

Journal Bearings: Introduction to idealized full journal bearings. Load carrying capacity of idealized full journal bearings, Sommerfeld number and its significance. Comparison between lightly loaded and heavily loaded bearings, Numerical problems.

UNIT V **(12)**

Bearing materials: General requirements of bearing materials, Types of bearing materials.

Surface Engineering: Surface modifications, transformation hardening, surface fusion, thermo chemical processes, surface coatings, plating and anodizing, fusion processes, vapour phase processes.

LEARNING RESOURCES

TEXT BOOKS:

1. "Principles of Tribology" by Halling j., McMillan Press Ltd , 1975.
2. Fundamentals of Tribology, Basu, SenGupta and Ahuja/PHI
3. Tribology in Industry : Sushil Kumar Srivatsava, S. Chand &Co

REFERENCES:

1. *Tribology Hand Book", by Neale M.J., Butterworths 2nd Edition , 1999.*
2. Mujamdar.B.C "Introduction to Tribology of Bearing", Wheeler Publishing,New Delhi2001.

WEB REFERENCE:

- *http://www.imeche.org/knowledge/industries/tribology/about-the-group/terms-of-reference*
- *http://www.crcnetbase.com/doi/abs/10.1201/9780849377877.sec4*
- *http://www.ntnu.edu/ipm/tribology-lab*

ME 311C	ELECTIVE I AUTOMOBILE ENGINEERING	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Acquisition of sufficient knowledge to classify Engines, Chassis, Fuel Supply Systems.
2. Cooling Methods, Lubrication Methods, Ignition Systems, Starting systems, Generating Systems,
3. Acquisition of sufficient knowledge to Chassis, Clutch, Power train Systems.
4. Acquisition of working knowledge of Suspension and braking methods.
5. Acquisition of working knowledge of Assembly of various Components, layout and of various electrical equipment of an automobile.

COURSE OUTCOMES:

a. Identify the components of an automobile.
b. Analyze the working of each of the components.
c. Modify the design of the components.
d. Repair and maintain some of the components.
e. Predict the possible breakdowns. Modernize the components for the performance improvement.

UNIT I **(12)**

Introduction: Classification of vehicles - applications, options of prime movers, Arrangements of drive.

Engine: Classifications based on number of strokes, cylinders, types of combustion of combustion chambers for petrol and diesel engines, valves, valve Arrangements and operating Mechanisms, Piston types, Piston rings, firing order; Crankshafts, Flywheel.

UNIT II **(12)**

Assorted Equipment: Fuel supply pumps, A.C. Mechanical and S.U.Electrical type diaphragm pumps, Air and Fuel Filters, super chargers, Mufflers.

Cooling Systems: Need for cooling system, Air and water cooling

Lubricating Systems: Various lubricating systems for I.C. Engines

Ignition System: Ignition system, Spark Plugs, Distributor

UNIT III **(12)**

Electrical system: Electronic Ignition, Alternator, Cutout, Current and Voltage regulators, charging circuit, starting motors, lighting, instruments and accessories.

Chassis & transmission systems: Introduction to Chassis &Transmission, Clutches-Single-plate and Multi-plate clutches, Centrifugal clutches, wet and dry type, actuating mechanisms.

UNIT IV (12)

Transmission: Gear Box - Theory, Four Speed and Five Speed Sliding mesh, Constant mesh & Synchro-mesh type, selector mechanism, Automatic transmission, overdrive, propeller shaft, differential – principle of working.

Suspension Systems: Need for suspension systems, springs, shock absorbers.

UNIT V (12)

AXLE AND WHEEL ALIGNMENT: Axles front and rear, different methods of floating rear axle, front axle and wheel alignment.

Road Wheels: Tyres, Tube and Tube less wheels.

Vehicle Control: steering mechanisms and power steering, types of brakes and brake actuation mechanisms (air and hydraulic).

Learning resources:

TEXT BOOKS:

1. Automobile Engineering - Vol I & II - Kirpal Singh, Standard Publishers, 2011
2. Automobile Engineering - R.B.Gupta, Satya Prakasan, 2009
3. Automobile Engineering - G.B.S.Narang, Khanna Publishers, 7th Reprint, 2011.

REFERENCE BOOKS:

1. Automotive Mechanics - Joseph Heitner, Van Nostrand Company, 2007
2. Automobile Engineering - S.Srinivasan, 2007, TMH.
3. Automobile Engineering - K. Ramakrishna, PHI, New Delhi, 2012.

Books in Digital Library:

- *www.nptel.iitm.ac.in*

RELEVANT WEB SITES:

- *www.sciencedirect.com*
- *www.2.accessengineeringlibrary.com.*
- *www.asmedl.aip.org*
- *www.ieee.org/ieeexplore*

ME 311D	ELECTIVE I (INDUSTRY BASED ELECTIVE) INTRODUCTION TO AIRCRAFT INDUSTRY AND SYSTEMS	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

At the end of this course the student should have the knowledge of

1. Aircraft Fundamentals & Principles
2. Aircraft Structures
3. Aircraft Performance and Stability.
4. Aerodynamics
5. Aircraft Configuration.

COURSE OUTCOMES:

a. Get the basic idea on the aeronautics.
b. Understand the basic concepts of aerodynamics and structures
c. Know the various components and parts of the aircrafts.
d. Know the current trends of engine and control systems used in aircrafts.
e. Learn the generalized concepts of aircraft stability and control.

UNIT I (12)

HISTORICAL EVALUTION AND AIRCRAFT CONFIGURATIONS

Early airplanes, Multi-planes, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years, Components of an airplane and their functions, Different types of flight vehicles and Classifications, Basic instruments for flying.

UNIT II (12)

INTRODUCTION TO PRINCIPLES OF FLIGHT AND POWER PLANTS USED IN AIRPLANES

Physical properties and structure of the atmosphere, Temperature, pressure and altitude relationships, Aerofoil, Mach number, Reynolds Number, Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust production, Comparative merits

UNIT III (12)

INTRODUCTION TO AIRPLANE STRUCTURES AND AERODYNAMICS

General types of constructions, Monocoque, semi-Monocoque and geodesic construction, typical wing and fuselage structure, Aerodynamic forces on a wing, force coefficients. Generating lift, Moment coefficients, Center of Pressure, Sources of drag.

UNIT IV (12)

AIRCRAFT PERFORMANCE: Aircraft performance parameters, performance in steady flight and accelerated flight.

UNIT V **(12)**

AIRCRAFT STABILITY: Static and dynamic stability, longitudinal, lateral and directional stability (brief introduction).

TEXT BOOKS:

1. Anderson, J.D., "Introduction to Flight", McGraw Hill, 2013.
2. Kermode, A.C., "Flight without Formulae", McGraw Hill, 1987.
3. Clancy, L.J., "Aerodynamics", Pitman, 1986

WEB RESOURCES:

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

ME 312A	ELECTIVE II MEASURMENTS AND CONTROL SYSTEMS	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Students will be able to understand the basic concepts of Measurements and measuring equipments, statistical analysis of errors.
2. Students will be able to design and use sensors and Transducers to inspect the components.
3. Students will be able to know the working of strain gauges and bridge circuits for different applications
4. Students will be able to understand the working of pressure , temperature , flow meters flow visualization methods , different force , torque, power measuring devices, dynamometers, Vibrometers and accelerometers.
5. Students will be able to identify the required control systems for various equipment's.

COURSE OUTCOMES:

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

a. Select the suitable method for processing of errors.
b. To use the different Sensors for various applications.
c. Manufacture them professionally to reduce the rejection rates in manufacturing sector.
d. Select the suitable instrument to measure the parameters like pressure, temperature, force, Torque, etc.
e. Analyze various types of measuring equipments used in control systems.
f. Communicate effectively with the workers regarding the method of operation of the measuring equipment.

UNIT I (12)

Basic Concepts: Introduction, Measurement system elements, Definitionof terms: Calibration, standards, Accuracy, Precision, Sensitivity,Resolution. Standard test inputs, Characteristics of zero, first and second ordersystems, Steady state error analysis, Transient response specifications,stability analysis of a system.

Measurement Errors And Statistical Analysis: Classification of Errors,error analysis: Statistical analysis of test data- probability distributions -method of least squares, standard deviation of the mean, Graphicalanalysis and curve fitting.

UNIT II (12)

Sensors and Transducers: Introduction, Transducer classification,transducer elements, variable resistance transducer elements, Variableinductance transducer elements, capacitive, Piezo electric, photo electric,Ionization transducers. Optical encoder.

Strain Measurement: Introduction, electrical resistance strain gaugesprinciple, Method of fixing and bridge circuits for measuring strainchanges, Gauge factor, Temperature compensation strain gauge. Rosette,Strain gauge applications.

UNIT III **(12)**

Pressure Measurement: Introduction, pressure measurement terms,Pressure UNITs, Bourdon tube pressure gauge, Diaphragm and Bellows,Bridgeman gauge, Low pressure measurement: McLeod gauge, thermalconductivity gauge.

Temperature Measurement: Introduction, Liquid in glass thermometers,Bi-metallic thermometers, Thermo-Resistive elements, Thermocouples,Thermisters and Pyrometers.

UNIT IV **(12)**

Flow Measurement: Introduction. Variable head flow meters, variablearea flow meters, Hot-wire anemometer. Flow visualization methods.

Vibration Measurement: Principle of seismic instruments such asVibrometers and accelerometers.

Force, Torque and shaft power Measurement: Introduction, Elastic force meters, Load cells. Torque Measurement: Optical torsion meter, Electrical Torsion meter,strain gauge torsion meter. Shaft Power Measurement: Dynamometers-Mechanical, electrical, Hydraulic.

UNIT V **(12)**

Introduction to control Systems: Introduction Definitions of controlsystem terminology, classification of control systems, examples of controlsystems.

Basic Control Actions: Types of control actions, proportional controllers,derivative and integral control actions, effects of derivative and integralcontrol action on system performance.

Mathematical Models of physical Systems: Definition of transferfunction, derivation of transfer functions of mechanical, electrical, thermaland hydraulic systems, block diagram algebra.

LEARNING RESOURCES

TEXT BOOKS:

1. Mechanical Measurements & Control - by D.S. Kumar, Metropoliton Book Company, 4th Reprint.
2. Mechanical Measurements by R.S.Sirohi & H.C.Radhakrishna, New Age International, 2008.

REFERENCE BOOKS:

1. Experimental methods for engineers - J.P.Holman, 6th Edition, 1994.
2. Mechanical Measurements - T.B.Beckwith&N.L.Buck , Addison-Wesley,1969
3. Control System Engineering - Nagarath&Gopal, New Age International, 2010.

WEB REFERENCES:

- *http://emtool box.nist.gov*
- *CambridgeViscosity.com/Viscometer*
- *www.e.FlukeCal.com/Calibration*

ME 312B	ELECTIVE II MECHANICS OF COMPOSITE MATERIALS	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Understanding the properties of fiber and matrix materials used in commercial composites, as well as some common manufacturing techniques.
2. Learn some common manufacturing processes and mechanical behavior of composite materials, especially of fiber composites.
3. Study the strength failure theories of an angle lamina
4. Predict Elastic and strength characteristics of the composite from the known mechanical properties of components and from their geometrical structure.
5. Study and evaluation of stresses, strains of typical structures made of composite materials.

COURSE OUTCOMES:

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

a. Identify the properties of fiber and matrix materials used in commercial composites
b. Predict the elastic properties of both long and short fiber composites based on the constituent properties.
c. Predict the failure strength of a laminated composite plates.
d. Analyze problems on micro and macro mechanical behavior of laminate.
e. Apply the mechanics of composites to design composite structural elements.

UNIT I **(12)**

Introduction to Composite Materials: Introduction, Classification: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon-Carbon Composites, Fiber-Reinforced Composites and nature-made composites and applications.

Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres, Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

UNIT II **(12)**

Manufacturing: Hand lay-up techniques, Bag moulding, Autoclave molding process, filament winding, Pultrusion, Pulforming, Thermoforming, Injection moulding.

Macromechanical Analysis of a Lamina: Introduction, Definitions: Stress, Strain, Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials, Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

UNIT III **(12)**

Hooke's Law for a Two-Dimensional Angle Lamina, Engineering Constants of an Angle Lamina, Invariant Form of Stiffness and Compliance Matrices for an Angle Lamina.

Strength Failure Theories of an Angle Lamina: Maximum Stress Failure Theory, Strength Ratio, Failure Envelopes, Maximum Strain Failure Theory, Tsai-Hill Failure Theory, Tsai-Wu Failure Theory, Comparison of Experimental Results with Failure Theories.

UNIT IV (12)

Micromechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach.
Semi-Empirical Models, Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion.

UNIT V (12)

Macromechanical Analysis of Laminates: Introduction, Laminate Code, Stress-Strain Relations for a Laminate, In-Plane and Flexural Modulus of a Laminate.
Failure, Analysis and Design of Laminates: Introduction, Special Cases of Laminates, Failure Criterion for a Laminate, Design of a Laminated Composite, Other Mechanical Design Issues.

LEARNING RESOURCES

TEXT BOOKS:

1. Autar K. Kaw, Mechanics of Composite Materials, Publisher: CRC press / Taylor & Francis, Second Edition.
2. Isaac M. Daniel and Ori Ishai, Engineering Mechanics of Composite Materials, Oxford University Press, New York, Second Edition.

REFERENCES:

1. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, NY.
2. L. R. Calcote, Analysis of Laminated Composite Structures, Van N Rainfold, NY.

WEB RESOURCES

- http://nptel.iitm.ac.in/
- http://composite.about.com/
- http://www.springer.com/materials

ME 312C	ELECTIVE II REFRIGERATION AND AIR CONDITIONING	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To know the various methods of refrigeration and to introduce vapour compression.
2. Refrigeration cycle, analysis and methods for improving performance.
3. To know the operation of vapour absorption system.
4. To know the various components of refrigeration system and their working principles.
5. To design air conditioning systems by cooling load calculations. To know the various applications of refrigeration and air conditioning systems.

COURSE OUTCOMES:

a. The students will get the knowledge about the principle of refrigeration, different methods of refrigeration.
b. Able to know the various components of refrigeration system and their working principles.
c. Able to understand what is meant by air conditioning and various psychrometric properties and processes and know the usage of Psychrometric chart.
d. Know how to provide required environment to suit various needs of day to day requirements like comfort air conditioning, water cooling , storage of perishable food etc.,
e. Enable them to do simple design calculations and analysis of these systems.

UNIT I **(12)**

INTRODUCTION TO REFRIGERATION: Necessity and applications, UNIT of refrigeration and C.O.P, Mechanical refrigeration, types Reversed Carnot cycle of refrigeration.

AIR REFRIGERATION: Bell Coleman cycle, Open and Dense air systems, Actual refrigeration system. Necessity of aircraft refrigeration, Aircraft refrigeration systems-Types.

UNIT II **(12)**

Refrigerants: Refrigerants Classification, desirable properties, commonly used refrigerants, nomenclature, Alternate refrigerant.

Vapour Compression Refrigeration: Working principle, essential components of plant, simple vapor compression refrigeration cycle, modifications, Use of P - h charts.

UNIT III **(12)**

System Components: Compressors-types, Condensers - classification, working, Evaporators - classification, working, Expansion devices - types, working.

VAPOUR ABSORPTION SYSTEM: Calculation of max COP, description and Working of NH3-water system, Li-Br,H_2O system, principle of operation of three fluid absorption system and salient features.

UNIT IV **(12)**

STEAM JET REFRIGERATION SYSTEM: Principle of working, application merits and demerits.

NON-CONVENTIONAL REFRIGERATION METHODS: Principle and operation of thermoelectric refrigerator and Vortex tube or Hirsch tube.

Psychrometry: Introduction, Psychrometric properties and relations, Pchrometric chart. Psychrometric processes, Sensible, Latent and Total heat, Sensible Heat Factor (SHF), Bypass factor.

UNIT V **(12)**

Introduction to Air Conditioning: Need for ventilation, infiltration, concepts of RSHF, ASHF, ESHF & ADP, concept of human comfort and effective temperature, comfort air conditioning, industrial air conditioning requirements, air conditioning load calculations.

Air Conditioning Systems: Introduction, components of Air conditioning system, Classification of Air conditioning systems, Central and UNITary, Summer, Winter and Year round systems.

TEXT BOOKS:

1. Refrigeration and air conditioning – R.S. Khurmi & Gupta
2. Refrigeration and air conditioning – C.P Arora
3. Refrigeration and air conditioning- Manohar Prasad
4. A Course in refrigeration and air conditioning a– S.C Arora &Domkundwar

REFERENCE BOOKS:

1. Principles of Refrigeration -- Dossat
2. Refrigeration and air conditioning -- Stoecker

WEB RESOURCES:

- *http://www.refrigerationbasics.com/index.htm*
- *http://www.howstuffworks.com/ac.htm*
- *http://www.ashrae.org*
- *http://www.taftan.com/thermodynamics/AIRCOND.HTM*
- *http://www.wisegeek.com/how-does-air-conditioning-work.htm*

ME 312D	ELECTIVE II (INDUSTRY BASED ELECTIVE) PRODUCT LIFE CYCLE MANAGEMENT	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

This course provides an understanding of

1. The types of data generated and used in the product lifecycle
2. The current tools and methodologies in the management of that data,
3. System analysis and implementation techniques for using PDM as the backbone supporting a company's product development and implementation activities.
4. Interaction between various enterprise systems.

COURSE OUTCOMES:

a. Explain the meaning of and the difference between the terms PDM and PLM
b. Describe how a relational database is built and how it is used
c. From an information model, create a database structure and populate it with relevant data
d. Write simple SQL expressions for creating/retrieving relevant data in a relational database
e. Explain the basic components and functionality of a PDM system
f. From a given database structure, use and make small adjustments to a PDM system
g. From a given activity model, use a PDM system to support and control a product realization process
h. Given project, choose, configure, and adjust a PDM system to effectively support, follow up and control the project.

UNIT I

INTRODUCTION TO PRODUCT LIFE CYCLE MANAGEMENT (PLM) (12)

Definition, PLM Lifecycle model, Threads of PLM, Need for PLM, OpportUNITies and benefits of PLM, Views, Components and Phases of PLM, PLM feasibility study, PLM visioning – PLM Concepts, Processes and Workflow: Characteristics of PLM, Environment driving PLM,PLM Elements, Drivers of PLM, Conceptualization, Design, Development, Validation, Production, Support of PLM.

UNIT II

PRODUCT DATA MANAGEMENT (PDM) PROCESS AND WORKFLOW (12)

PDM systems and importance, reason for implementing a PDM system, financial justification of PDM implementation. Versioning, check-in and checkout, views, Metadata, Lifecycle, and workflow. Applied problems and solution on PDM processes and workflow.

Collaborative Product Development: Engineering vaulting, product reuse, smart parts, engineering change management, Bill of materials and process consistency, Digital mock-up and prototype development, design for environment, virtual testing and validation, marketing collateral.

UNIT III
TOOLS OF COMMUNICATION FOR COLLABORATIVE WORK (12)

Creation of 3DXML and CAD drawing using CAD software. Creation of an animation for assembly instructions on 3D via composer, creation of an acrobat 3D document. Applied problems and solutions on tools of communication for collaborative work.

UNIT IV
KNOWLEDGE AND OPTIMIZATION OF DESIGN PRODUCTS (12)

Know how, best practices, parameterization of design, Applied problems and Solution on optimization of products using power copy, publication, parameters, formula, rule, check, design table, configuration, reaction.

UNIT V
DIGITAL MANUFACTURING – PLM (12)

Digital manufacturing, benefits manufacturing, manufacturing the first-one, Ramp up, virtual learning curve, manufacturing the rest, production planning. Developing a PLM strategy and conducting a PLM assessment: Strategy, Impact of strategy, implementing a PLM strategy, PLM initiatives to support corporate objectives. Infrastructure assessment, assessment of current systems and applications.

TEXT BOOKS:

1. Grieves, Michael. “Product Lifecycle Management”, McGraw-Hill, 2006.
2. Burden, Rodger “PDM: Product Data Management”:, Resource Pub, 2003.

REFERENCES:

1. Fabio Guidice, Guido La Rosa, “Product Design for the environment- A life cycle approach”, Taylor and Francis 2006.
2. Robert J. Thomas, “New product development: managing and forecasting for strategic success”, J. Wiley, 1993.
3. Gerd Hartmann, Ulrich Schmidt, “Product life cycle management” with SAP, Galileo Press, Incorporated, 2005.
4. Stark, John, “Product Life Cycle Management: Paradigm” for 21st Century Product Realization, Springer-Verlag, 2004.
5. Saaksvuori, Antti and Immpnen, Anselmi. “Product Lifecycle Management”, Springer-Verlag, 2004.

ME 354	ANALYSIS LAB	L	T	P	M	C
		-	-	3	100	2

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.
5. Study the physical responses, such as stress levels , temperature distribution etc.

COURSE OUTCOMES:

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

a. Understand the basics of ANSYS capabilities, terminology and the GUI.
b. Know how to perform a complete ANSYS analysis step-by-step.
c. Acquire the knowledge in building solid models & meshing, apply loads, solving & reviewing results
d. Be in a position to model and analyse for finding stress, temperature distribution etc, with the help of suitable boundary conditions.
e. Solve various engineering problems in structural, thermal and fluid mechanics.

The following analysis can be performed by using any of the analysis software(s) like ANSYS, ALGOR, NASTRAN, NISA, ABAQUS etc.

1. STATIC ANALYSIS: Truss and Frame Structures

i 2-D truss
ii 3-D truss
iii Beam analysis

2.STATIC ANALYSIS: Two Dimensional Problems

i 2-D structure with various loadings
ii 2-D structures with different materials
iii Plate with hole

3. DYNAMIC ANALYSIS: Modal And Transient Analyses

i Modal analysis of Solid Structure (Work Table)
ii Transient Response (spring-mass system)

4. NON-STRUCTURAL PROBLEMS

i Steady State heat transfer
ii Transient heat transfer
iii Fluid Analysis

LEARNING RESOURCES

REFERENCES:

- Introduction to Finite elements in Engineering by Chandrupatla & Belegundu, PHI, 2010.
- www.mece.ualberta.ca.
- Ansys, " Multiphysics User's Manual"

ME 355	HEAT TRANSFER LAB	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

To understand the basics of heat transfer and applications of heat transfer.

COURSE OUTCOMES:

To know Applications of heat transfer in daily life.

Tests on Any **Ten** of the Following are to be conducted:

1. Refrigeration Test Rig
2. Air Conditioning Test Rig
3. Heat Exchanger - Parallel Flow
4. Heat Exchanger - Counter Flow
5. Emissivity Apparatus
6. Pin fin - Natural Convection & Forced Convection
7. Natural Convection from vertical Cylinder
8. Stefan - Boltzmann's Apparatus
9. Axial conduction in metal rod
10. Lagged Pipe apparatus
11. Composite slab
12. Automobile chassis - Steering and transmission systems

ME 356	INDUSTRY BASED LAB	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

To get familiarize with the applications and advancements of Core Subjects in the Industry.

COURSE OUTCOMES:

To prepare the students to the industry needs

- On consultation with Industry, Training is Provided on Latest Mechanical Software / Core Concepts that are practicing in the industry now a days.
- LAB Structure will be prepared in consultation with industry and due permission is taken from BOS.
- Marks will be awarded, similar to other lab(s).

IV YEAR

ME 401	ENGINEERING METROLOGY	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Students will be able to understand basic concepts of Measurements and measuring equipments.
2. 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.
3. Students will be able to understand the working of sine bar and slip gauges, comparators.
4. Students will learn about terminology related to surface structure based on Indian standard organization.
5. Student will study about the elements of screw thread measurements and about the gauges used to check the screw threads.
6. Students will understand the alignment of machines like bed and chucks etc., on different machine tools and their performance.
7. Students will be able to understand different terms like calibration accuracy precision and resolution etc., related to measuring equipments.

COURSE OUTCOMES:

a. Analyze various methods of designing of gauges, measuring equipments used in the inspection and quality control department, examples plug gauges, ring gauges and dial gauges etc.,
b. To use the different comparators and design of the comparators.
c. Manufacture them professionally and with regard to their responsibilities to society, especially with respect to designing of measuring equipment to reduce the rejection rates in manufacturing sector.
d. Communicate effectively with the workers regarding the methods of operating the measuring equipment and design of the equipment.
e. To know the purpose and principles of alignment tests.

UNIT I **(12)**

Metrology: Introduction, Elements of engineering measurements, Linear measurements, 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.

UNIT II **(12)**

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 III (12)

Comparators: Mechanical comparators, Reed comparator, Sigma comparator, electrical and electronic comparators, solex pneumatic gauge, projectors, tool maker's microscope.

Metrology of Screw Threads And Gears: Measurement of various elements of threads, major, minor and effective diameter, thread micrometer, measurement of pitch, gear inspection, measurement of tooth thickness, gear tooth caliper.

UNIT IV (12)

Control Charts: X and R charts, Attributes, P-chart, C-Chart, U Chart.

Measurement Of Surface Finish: Surface texture, roughness, waviness, Indian standard terminology, Methods of measuring surface finish, Taylor Hobson Talysurf.

UNIT V (12)

Interferometry: NPL flatness interferometry and gauge length interferometer, auto collimator.

Static & Dynamic Alignment Tests: Alignment tests on Lathe, Drilling Machine and Milling Machine.

LEARNING RESOURCES

TEXT BOOKS:

1. Engg. Metrology - R.K.Jain ,Khanna publishers , 20th Edition , 2012.
2. Hand Book of Industrial Metrology by ASTME , Prentice-Hall (1967)

REFERENCE BOOKS:

1. Engg.Metrology - D.M.Antony
2. A Text book of Engg.Metrology - I.C.Gupta ,Dhanpat Rai Publications,Edition 7.

WEB REFERENCES

- *http://emtool box.nist.gov*
- *CambridgeViscosity.com/Viscometer*
- *www.e.FlukeCal.com/Calibration*
- *www.inscotemperature.com/*
- *www.solartronmetrology.com/*

ME 402	ADVANCED MACHINE DESIGN	L	T	P	M	C
		4	1	-	100	3

COURSE OBJECTIVES:

1. Enable students to attain the basic knowledge required to understand, analyze, design and select machine elements.
2. Understand the theory and its limitations and to design the machine element to perform a specified duty.
3. Apply the systematic engineering design process including, problem definition, information collection, concept generation & selection, and design configuration to design of mechanical systems and elements.
4. To develop an ability to design a system, component, or process to meet desired needs with in realistic constraints.
5. Apply optimization methods to determine the optimal solution for design Configurations

COURSE OUTCOMES:

a. Be able to approach a design problem successfully, taking decisions when there is not a uniqueanswer.
b. To master the fundamental processes of design and manufacturing and to gain an in-depth understanding of analytical and experimental methods of determination of stresses and strength of machine elements under various loading conditions.
c. Demonstrate knowledge on basic machine elements used in machine design; design machine elements to withstand the loads and deformations for a given application, while considering additional specifications.
d. Analyze and dimension both simple products as well as subsystems of more complicated mechanical products in an engineering manner.
e. Through the study of optimum design, reliability and system design he will be able to assess the life of mechanical elements.

UNIT I **(12)**

HELICAL SPRINGS: Introduction; Materials; Types of springs, Helical springs under axial load, Fatigue loading, Design of Concentric helical springs

TORSION AND LEAF SPRINGS: Torsion springs, Spiral springs, leaf springs

UNIT II **(12)**

BRAKES: Introduction to Brakes, Types, Analysis and design of block brakes, band brakes, block and band brakes; Internal shoe brakes, pivoted shoe brakes, Temperature rise, Friction materials.

CLUTCHES: Analysis and design of simple and multiple disc clutches, cone clutches and centrifugal clutches.

UNIT III **(12)**

FLYWHEEL: Introduction, construction, Torque analysis, solid flywheel, Rimmed flywheel, stresses in rimmed flywheel, Design of flywheel.

CYLINDER: Cylinder, Cylinder liners, Design of a cylinder, Material for cylinder.

UNIT IV **(12)**

PISTION AND CONNECTING ROD: Introduction, Design of trunk type piston and connecting rod.

CRANK SHAFT: Design of overhung crank shaft.

UNIT V **(12)**

OPTIMUM DESIGN: Optimization functions of single variable and multi variables, optimization techniques, Interval halving and Golden section methods

RELIABILITY AND LIFE EXPECTANCES: Introduction, Method of achieving reliability, Series, Parallel and series and parallel reliability, Analysis

SYSTEM DESIGN: Introduction, Human aspects of design, Standardization, Practical tips for problems encountered in design with examples.

LEARNING RESOURCES

TEXT BOOKS:

1. Design of Machine Elements by V.B.Bhandari, Tata McGraw Hill, 3rd Edition, 2010.
2. Design of Machine Elements by C.S. Sharma & K. Purohit ,PHI Ltd,2004.
3. Machine Design by R.S. Khurmi& J.K. Guptha , S. Chand , 2012.
4. Reliability Engineering by L.S. Sreekanth, 4th Edtn, East West Press 2005.
5. Engineering optimization by S.S. Rao, John Willy & Sons, 2009.

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 - CBS Pub

WEB REFERENCES:

- http:// machinedesign.com
- http:// ptumech.loremate.com/md2/mode/6
- http:// ptumech.loremate.com/md2/mode/7
- http:// ptumech.loremate.com/md2/mode/8
- https://www.epictraining.ca/PEL/12484/Mississauga/MEC-B1/Advanced-Machine-Design

ME 403	MOOCS	L	T	P	M	C
		-	-	-	-	0

COURSE OBJECTIVES:
1.
COURSE OUTCOMES:
a.

CE 404A	OPEN ELECTIVE BASIC SURVEYING	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To study about the various surveying instruments.
2. To study the basics of chain survey in linear measurements.
3. To determine the relative positions of the existing features on the ground.
4. To obtain basic knowledge on Total Station.
5. To acquaint with procedures of leveling by dump level & auto level.

COURSE OUTCOMES:

By the end of the course surveying-I, the students will be able

a. To Know about the various surveying instruments.
b. To determine the relative positions of a point on the existing ground by conducting the survey.
c. To use all basic surveying instruments.
d. To operate Total Station instrument.
e. To take the levels of existing ground and to determine the reduced levels.

UNIT I *Surveying Vol. I by Dr. K. R. Arora* **(12)**

Surveying & Measurements: Definitions; Classification; Principles of Surveying; Basic measurements in surveying; Instruments used for different measurements; Units of measurement (linear & Angular); Plan and map; Scales used for Maps and plans; Phases of survey work and Duties of a surveyor. Procedures for distance measurement - Ranging, Chaining/taping a line.

UNIT II *Surveying Vol. I by Dr. K. R. Arora* **(12)**

Chain Surveying: Principle of Chain surveying; Basic definitions; Well-Conditioned & Ill-Conditioned triangles; Selection of stations and survey lines; Procedure of Field Work in Chain Surveying; Off-sets; Booking the survey (Field Book); Conventional Symbols; Problems encountered in chaining; Obstacles in chain Surveying.

UNIT III *Surveying Vol. I by Dr. K. R. Arora* **(12)**

Compass Surveying: Angles and Bearings; Instruments used to measure angles and bearings; Designation of Bearings; Fore and Back Bearings; Calculation of Included Angles from Bearings and Bearings from Included Angles; Prismatic & Surveyor's Compass; Magnetic Dip & Declination; Local Attraction and Corrections.

UNIT IV *Surveying Vol. I & II by Dr. K. R. Arora* **(12)**

Theodolite Surveying: Types of Theodolites; Vernier Theodolite - Essential Parts; Basic definitions; Temporary adjustments; Field operations - Measurement of horizontal angles(Repetition & Reiteration), vertical angles.

Total Station: Introduction; components of Total Station; Types of Prisms and targets used in total station; various advantages of Total Stations.

UNIT V *Surveying Vol. I by Dr. K. R. Arora* **(12)**

Simple Leveling: Basic definitions; Curvature and Refraction; Different methods of leveling; Levels - Dumpy level, Tilting level, Auto level; Leveling staff; Level field book; Booking and reducing levels; Classification of direct differential leveling methods -Fly leveling, Check leveling, Profile leveling and Cross sectioning, Reciprocal leveling and Precise leveling; Sources of errors & Difficulties in leveling.

LEARNING RESOURCES:

TEXT BOOKS:

1. Surveying Vol. I & II by Dr. K. R. Arora,11th Edition, Standard Book House,2012.
2. Surveying Vol. I & II by S K Duggal, 4th Edition, McGraw Hill Education (India) Private Limited, 2013.

REFERENCE BOOKS :

1. Surveying Vol. I&II by B.C. Punmia, Laxmi Publications,2005.
2. Surveying and Levelling by N.N Basak, McGraw Hill Education (India) Private Limited,2014.
3. Plane Surveying by AM Chandra, 2nd Edition, New Age International (P) Ltd.,2006.

WEB REFERENCES:

1. http://nptel.ac.in/courses/105104101/
2. http://nptel.ac.in/courses/105107121/
3. http://nptel.ac.in/courses/105107122/

CE 404B	OPEN ELECTIVE BUILDING MATERIALS & ESTIMATION	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1 To teach the basics involved in selection of good quality building materials for construction
2 To give knowledge about various building elements and their specifications
3 Presents the basics of planning strategies, building bye laws and acoustics of building
4 preparing tender notice and various approvals needed for a project
5 Valuation of building and rent fixation

COURSE OUTCOMES:

At the end of this course,

a. Students are familiar with various building materials
b. Students knows about various building elements and their specifications
c. Students are familiar with types of masonry works and bonds used in construction
d. Students are capable of understanding building plan and have knowledge about building rules, bye-laws and building elements
e. Students will have knowledge about Valuation of building and rent fixation

UNIT I **(12)**

Clay bricks: Brick clay, Preparation of bricks, Types of bricks, Dimensions of bricks, Weight of bricks, Storing of bricks, Brick substitutes, Classification of bricks, Tests for bricks.

Timber: Classification of trees, Structure of wood, seasoning and con-version of timber, Market forms of timber, Defects of timber, Treatment of timber, Classification of timber.

Glass: Manufacture and Classification, Treatment of glass, Uses of glass, testing for quality, Characteristics and Performance of glass, Glass fibre.

Plastics: Classification of plastics, Properties of plastics, Fabrication of plastic articles, some plastics in common use, Reinforced plastics.

UNIT II **(12)**

Cement: General, Manufacture of Portland cement by dry process, Approximate oxide composition limits of OPC, Bogue's compounds, Hydration of cement, heat of hydration, structure of hydrated cement.

Types of Cements: Ordinary Portland cement, low alkali cement, Rapid hardening cement, Sulphate resisting cement, Portland blast furnace slag cement, Portland pozzolana cement, air entraining cement, white cement, hydro phobic cement, oil well cement, low heat Portland cement.

UNIT III **(12)**

Building Rules and Bye-Laws: Zoning regulations; Regulations regarding layouts or sub-divisions; Building regulations; Rules for special type of buildings; Calculation of plinth, floor and carpet area; Floor space index.

Building Elements: Conventional signs; Guidelines for staircase planning; Guidelines for selecting doors and windows; Terms used in the construction of door and window; Specifications for the drawing of door and window.

UNIT IV **(12)**

Analysis of Rates : Task or out – turn work; Labour and materials required for different works; Rates of materials and labour; Preparing analysis of rates for the following items of work:

i) Concrete ii) RCC Works iii) Brick work in foundation and super structure iv) Plastering v) CC flooring vi) White washing.

PWD Accounts and Procedure of Works : Organization of Engineering department; Work charged establishment; Contract; Tender; Tender notice; Tender Schedule; Earnest money; Security money; Measurement book; Administrative approval; Technical sanction; Plinth area; Floor Area; Carpet area; Approximate Estimate; Plinth area estimate; Revised Estimate; Supplementary estimate.

UNIT V **(12)**

Valuation: Cost; Price & value; Methods of valuation; Out goings; Depreciation; Methods for Estimating cost depreciation; Valuation of building.

Miscellaneous Topics : Gross income; Net income; Scrap value; Salvage value; Obsolescence; Annuity; Capitalized value; Years purchase; Life of structures; Sinking fund; Standard rent; Process of fixing standard rent; Mortgage.

LEARNING RESOURCES:

TEXT BOOKS:

1 Estimating & Costing in Civil Engineering by B.N. Dutta; UBS Publishers & Distributors, 2010.
2 Building Materials by P.C. Vergese, 1st Edition,PHI,2009.
3 Building construction by P.C. Vergese, 1st Edition ,PHI, 2009.

REFERENCE BOOKS:

1 Engineering Materials by Rangawala, Charotar Publications, Fortieth Edition: 2013
2 Building construction by BC Punmia et al., 10th Edition,Laxmi Publications, 2008.
3 Building planning, designing and scheduling by Gurucharan Singh,Standard book House, 2006.

WEB REFERENCES:

1 http://nptel.iitm.ac.in/courses.php
2 http://freevideolectures.com/Course/86/Building-Materials-and-Construction
3 http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv053-Page1.htm
4 http://bookmoving.com/register.php?ref=Building%20materials%20rangwala
5 http://bookmoving.com/book/building-materials_654.html

CH 404A	OPEN ELECTIVE ENERGY ENGINEERING	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To provide the knowledge about formation, classification, ranking, analysis, testing, carbonization, gasification and liquefaction of coal, manufacture of cock.
2. To provide the knowledge about design, occurrence, composition, classification, exploration and production of petroleum, refining, testing and analysis of petroleum products.
3. To provide knowledge about the non -conventional energy resources sun and wind.
4. To provide knowledge about the non -conventional energy resources like ocean thermal, geothermal energy, biomass and fuel cells
5. To provide knowledge about the energy storage and related problems in the world and its solutions.

COURSE OUTCOMES:

a. An ability to understand the importance of environment and conservation of natural resources.
b. An ability to succeed in the competitive exams of energy industry.
c. An ability to utilize the non-conventional energies in place of conventional energies and its manufacture.
d. An ability to utilize the non- conventional energies in place of conventional energies and its manufacture.
e. An ability to maintain the sustainability in the environment

UNIT – I **(12)**

Conventional energy resources, the present scenario, scope for future development.

Coal: Origin, occurrence and reserves, classification, ranking, analysis and testing, coal carbonization, manufacture of coke, coal gasification, coal liquefaction.

UNIT – II **(12)**

Petroleum: Origin, occurrence and reserves, composition, classification, characteristics, explorationand production-.

Petroleum Refining:, petroleum products, testing and analysis of petroleum products, Refinery processes- Distillation, cracking, reforming and alkylation, polymerization& isomerization .

UNIT – III **(12)**

Non- conventional energy sources: Solar energy**:** Solar energy, solar radiation, solar collectors-flat plate, concentrating (focusing and non- focusing)collectors , principles of heating and cooling, photo voltaic cells.

Wind energy :Basic principles, basic components, classification of WECS, types of wind machines(horizontal, vertical axis machines) Wind energy conversion systems-horizontal and vertical systems. Applications.

UNIT – IV (12)

Non- conventional energy sources:

Ocean thermal energy - introduction, OTEC (Closed and open OTEC cycles),applications. Geothermal energy- introduction, sources, hydrothermal resources (Liquid and vapor dominated systems), applications.

Bio-mass energy- Introduction, conversion techniques, classification and Types of biogas plants, Hydrogen energy-Introduction,hydrogen production,storage and applications. Fuel cells-introduction, classification, types, advantages and applications.

UNIT –V (12)

Energy storage: introduction, storage systems. Mechanical energy storage- pumped hydroelectric, compressed air, fly wheel storage. Electrical storage- lead acid battery. Chemical storage- via hydrogen, ammonia, chemical reactions.Thermal energy storage- latent ,sensible heat storage. Solar pond

Energy Conservation: Conservation methods in process industries, Theoretical analysis, practical limitations, equipment for energy saving / recovery- recuperators, regenerators, pipes and pumps.

TEXT BOOKS:

1. Non-conventional energy resources by G. D. Rai, Khanna Publishers(2004)
2. Engineering chemistry by Jain& Jain 15 th edition

REFERENCE BOOKS:

1. Conventional Energy technology by S.B.Pandy, Tata McGraw Hill (1987)
2. Elements of Fuels ,furnaces and refractories O.P.Gupta , Khanna publishers(2000)

CH 404B	OPEN ELECTIVE BIO - FUEL	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To provide the knowledge about properties, composition, features of bio fuels and uses of biomass and their environmental impacts.
2. To provide the students a substantial knowledge of bio fuel production technologies.
3. To provide knowledge about the process of biogas production and methods of production of biodiesel and comparison of the standards to the conventional diesel.
4. To provide knowledge about the production of lipids, bio hydrogen from different bacteria and algae.
5. To provide knowledge about the fuel cell technology

COURSE OUTCOMES:

a. An ability to describe the functional principle of biofuel technologies in small and large scale.
b. An ability to describe the main steps and components in bioethanol, biodiesel and biogas production.
c. An ability to Participate actively in teamwork and work with case related problem solving.
d. An ability to work with professional problem solving in an industrial environment.
e. An ability to work in other fields of engineering.

UNIT – I **(12)**

Types of biomass (e.g. wood waste, forestry residues, agricultural residues, perennial annual crops, organic municipal solid waste). Composition of lignocellulose (lignin, hemi cellulose, cellulose); energy crops; chemical pretreatment; enzymatic pretreatment; degradation of cellulose; trichodermacellulases; bacterial cellulases; and comparison with degradation of high starch crops.

Sources of energy, introduction of biofuels, availability of bio mass, composition of biomass, terrestrial biomass, aquatic biomass.Physical and chemical properties of biomass. Useful and undesirable features of biofuels.

UNIT – II **(12)**

Biogas: The substrate, the digester, the microorganisms, the process of bio gas production, factors affecting bio gas yields, advantages, disadvantages.

Bioethanol: Bioethanol vs. Petrol, production of bio ethanol, ethanol recovery. Bio butanol.Properties and standards of bioethanol. Lignocellulosic biomass composition and characterizations.

UNIT –III (12)

Sources and processing of biodiesel (fatty acid methyl ester); nature of lipids, especially fatty acids and triglycerides. Sources and characteristics of lipids for use as biodiesel feedstock; and conversion of feedstock into biodiesel (transesterification). Use of vegetable oil (SVO) and waste vegetable oil (WVO).

Engineering, economics and environmental issues of biodiesel; major policies and regulations pertaining to the production, distribution, and use of biodiesel. Comparison of bio diesel with conventional diesel. Standards of bio diesel, current technologies and challenges.

UNIT – IV (12)

Hydrogen Production - Direct electrolysis of water, thermal decomposition of water, biological and biochemical methods of hydrogen production - Storage of Hydrogen - Gaseous, Cryogenic and Metal hydride –

Bio hydrogen: Production of bio hydrogen from anaerobic bacteria, photosynthetic algae, photosynthetic–hydrogenase system. Pyrolysis, bio-oil upgradation,

UNIT – V (12)

Fuel cells: Enzymatic fuel cells, microbial fuel cells. Fuel Cell – Principle of working, construction and applications.

Fuels for Fuel Cells: Hydrogen, Hydrocarbon fuels, effect of impurities such as CO, S and others.

TEXT BOOKS

1. Robert C. Brown, “Biorenewable Resources: Engineering,” New Products from Agriculture, Wiley-Blackwell Publishing, 2003

REFERENCES:

1. Samir K. Khanal, “Anaerobic Biotechnology for Bioenergy Production: Principles and Applications,” Wiley-Blackwell Publishing 2008
2. Martin Kaltschmitt; Hermann Hofbauer.“Biomass Conversion and Biorefinery,” Springer Publishing, 2008.

CS 404A	OPEN ELECTIVE JAVA PROGRAMMING	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Understand the basic concepts and fundamentals of platform independent object oriented language.
2. Demonstrate skills in writing programs using exception handling techniques and multithreading.
3. Understand streams and efficient user interface design techniques.

COURSE OUTCOMES:

a. Use the syntax and semantics of java programming language and basic concepts of OOP.
b. Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
c. Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
d. Demonstrate how the java program communicates with the console and disk files using the concept of streams.
e. Design event driven GUI and web related applications which mimic the real word scenarios.

UNIT I **(12)**

Introduction: The History and Evolution of Java, an Overview of Java.

Data Types, Variables, and Arrays: The primitive types, variables, type conversion and casting, Automatic Type Promotion in Expressions, Arrays, Operators, Control statements.

Introducing Classes : Class fundamentals, Declaring the objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this keyword, Garbage Collection, the finalize() Method.

A Closer Look at Methods and Classes: Overloading Methods, Using objects as Parameters, Returning Objects, Introducing Access control, Understanding static and final keywords, Nested and Inner Classes.

UNIT II **(12)**

Inheritance: Inheritance Basics, Using super, Creating multilevel Hierarchy, When Constructors are executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, using final with Inheritance.

Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Default Interface Methods, Use static Methods in an Interface.

UNIT III (12)

String Handling: String class, StringBuffer class.

Exception Handling: Fundamentals, Exception types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions , Creating Your Own Exception Subclasses.

Multithreaded Programming : The Java Threaded Model, The Main Thread , Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Inter Thread Communication.

UNIT IV (12)

I/O Basics: Streams, Byte streams, Character streams, Reading Console Input, Writing Console Output, Reading and Writing Files.

The Applet Class: Applet Basics, Applet Architecture, An Applet Skeleton, Simple Applet Display Methods, Requesting Repainting, The HTML APPLET Tag, Passing Parameters to Applets.

UNIT V (12)

Event Handling: Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, The KeyEvent Class, Sources of Events, Event Listener Interfaces, Using The Delegation Event Model, Adapter Classes.

Introducing the AWT: Working with Windows, Graphics and Text, Using AWT Controls, Layout Managers and Menus.

TEXT BOOKS:

1. Java The Complete Reference 9th Edition, Herbert Schildt, Mc Graw Hill Education(India) Private Limited, New Delhi.

REFERENCE BOOKS:

1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI.
2. Introduction to Java programming, By Y.Daniel Liang,Pearson Publication.

CS 404B	OPEN ELECTIVE DATABASE MANAGEMENT SYSTEMS	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To understand the fundamental concepts, historical perspectives, current trends, structures, operations and functions of different components of Databases.
2. To understand the types of integrity constraints in a relational database system and the concepts of SQL to create and access the database.
3. To understand basic concepts of ER model and database design using normalization process.
4. To understand concurrency, Recovery techniques.

COURSE OUTCOMES:

a. An understanding of basic concepts and use of various database systems.
b. An ability to enforce integrity constraints to maintain validity & accuracy.
c. An ability to write relational expressions for the queries.
d. An ability to design and develop a database using normalization theory.
e. An ability to use different concurrency control and Recovery techniques.

UNIT I **(12)**

Databases and Database Users: Introduction - An Example - Characteristics of the Database Approach - Actors on the Scene - Workers behind the Scene - Advantages of Using the DBMS Approach.

Database System Concepts and Architecture: Data Models, Schemas, and Instances - Three-Schema Architecture and Data Independence - Database Languages and Interfaces - The Database System Environment - Centralized and Client/Server Architectures for DBMSs

UNIT II **(12)**

Data Modeling Using the Entity-Relationship (ER) Model: Using High- Level Conceptual Data Models for Database Design - An Example Database Application - Entity Types, Entity Sets, Attributes, and Keys - Relationship Types, Relationship Sets, Roles, and Structural Constraints - Weak Entity Types

The Relational Data Model and Relational Database Constraints: Relational Model Concepts - Relational Model Constraints and Relational Database Schemas - Update Operations, Transactions, and Dealing with Constraint Violations.

UNIT III **(12)**

SQL-99: Schema Definition, Constraints, Queries, and Views: SQL Data Definition and Data Types - Specifying Constraints in SQL - Schema Change Statements in SQL -

Basic Queries in SQL – More Complex SQL Queries - INSERT, DELETE, and UPDATE Statements in SQL - Views (Virtual Tables) in SQL.

UNIT IV (12)

Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas - Functional Dependencies - Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

Introduction to Transaction Processing Concepts and Theory: Introduction to Transaction Processing - Transaction and System Concepts - Desirable Properties of Transactions – Characterizing Schedules Based on Recoverability -Characterizing Schedules Based on serializability.

UNIT V (12)

Concurrency Control Techniques: Two-Phase Locking Techniques for Concurrency Control - Concurrency Control Based on Timestamp Ordering.

Database Recovery Techniques: Recovery Concepts – Recovery Techniques Based on Deferred Update - Recovery Techniques Based on Immediate Update - Shadow Paging.

TEXT BOOK:

1. "Fundamentals of Database Systems", Ramez Elmasri and SHamKanth B.Navate Pearson Education, 5th edition.

REFERENCE BOOKS:

1. "Introduction to Database Systems", C.J.Date Pearson Education.
2. "Data Base Management Systems", Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill, 3rdEdition.
3. "Data base System Concepts", Abraham Silberschatz, Henry.F.Korth, McGraw hill, 5th edition.

EC 404A	OPEN ELECTIVE APPLIED ELECTRONICS	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To understand about various modern electronic systems.
2. To provide clear explanation of the operation of all the important electronic devices and systems available.
3. To know about modern audio and video systems.
4. To know about various Telecommunication Systems.

COURSE OUTCOMES:

a. Able to understand the working, types and applications of microphones and loudspeakers.
b. Able to understand the features of commercial, theatre sound recording and colour TV standards
c. Able to understand the working of various electronic systems, telecommunication and switching systems.
d. Able to understand the working of various applications like digital clocks, fiber optics, microprocessor and mobile radio systems.
e. Able to understand consumer electronic equipment and systems like washing machines

UNIT I (12)

Microphones: Characteristics of microphones, Types: Carbon microphones, moving coil microphones, ribbon microphones, electret microphones and wireless microphones.**Headphones:**Headphones and Headsets, Types of headphones.
Loud Speakers: Ideal loudspeaker,**Types:** Crystal loudspeaker, electrostatic loudspeaker, permanent magnet loudspeaker, **High frequency loudspeakers:** Horn type tweeters, **Equalizers and Mixers.**

UNIT II (12)

Commercial Sound: Recording, manual synthesizer, programmed synthesizer, public address systems, speaker matching systems, PA-system characteristics.**Theatre Sound System**,
Color TV standards and Systems: Primary and secondary colors, Luminance signal, Chrominance signal, color TV camera tube, color TV picture tube, NTSC system PAL system SECAM system.

UNIT III (12)

Audio systems,, Video Systems,Remote Controls, Modulation Techniques, Carrier Systems, Telecommunication Systems: telephone receivers and handsets, signaling-CCITT NO7, modes of operation, **Switching Systems:** principle,Read relay and cross bar switching, PBX switching, stored program control.

UNIT IV (12)

Fiber Optics, Data Services, digital clocks, microprocessor, microcontroller, Mobile radio systems: wireless local loop (WLL), role of WLL, radio paging service, digital cellular block diagram, establishing a call, **Fascimile (FAX).**

UNIT V (12)

IN-CAR Computers: Electronic ignition, electronic ignition lock system, ABS, Electronically controlled suspension (ECS), instrument pannel display, air-bag system. **Washing machines:** Electronic controller for washing machine, washing machine hardware, washing cycle, software and hardware development, **refrigeration systems**.

TEXT BOOKS:

S.P.Bali-Consumer Electronics-Pearson Education, ISBN: 9788131717592, first impression-2008.

REFERENCES:

1. Philip Herbert Hoff -Consumer Electronics for Engineers -Cambridge University Press (July 28, 1998), **ISBN-10:** 0521582075
2. Ronald K.Jurgen -Digital Consumer Electronics Handbook -(Editor) by McGraw Hill Professional Publishing, 1997. **ISBN-10:** 0070341435

WEB RESOURCES:

1.http://www.newagepublishers.com/samplechapter/000969.pdf
2.http://www.bits-pilani.ac.in:12354/qp1-9-10/EEE_C414_851_C_2009_1.pdf
3.http://nptel.iitm.ac.in

EC 404B	OPEN ELECTIVE BASIC COMMUNICATION	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To understand an overview of communication systems.
2. To understand the modulation technique, need of modulation,Amplitude modulation.
3. To understand fundamentals of digital communications
4. To understand broadband communication systems and Television fundamentals..

COURSE OUTCOMES:

a. Able to understand transmission of analog signals using amplitude modulation.
b. Able to understand transmission of digital signals through PCM, PAM, PPM and DELTA Modulation techniques
c. Able to know about various Broad band communication systems.
d. Able to know about the monochrome and colour Television fundamentals.
e. Able to know about Optical communication systems.

UNIT I *Text Book - 1* (12)

Communications: Communications systems, Information, Transmitter, Channel, noise, Receiver, Modulation, Description, Need for modulation, Bandwidth Requirements.
Amplitude Modulation: Amplitude Modulation Theory, Frequency spectrum of the AM wave, Representation of AM, Power relations in the AM wave, **Generation of AM,** Basic requirements, comparison of levels, Grid modulated class C amplifier, Plat modulated class C amplifier, Modulated transistor amplifiers.

UNIT II *Text Book -2* (12)

DIGITAL COMMUNICATIONS

Digital Communications: Digital Technology, Digital fundamentals, sampling theorem, aliasing effect, pulse amplitude modulation (PAM), synchronization in PAM systems, pulse time modulation, spectra of PDM and PPM systems, Elements of pulse code modulation (PCM), sampling and quantization, encoding, regeneration, decoding, DPCM, delta modulation.

UNIT III *Text Book - 1* (12)

Broadband Communications Systems: Multiplexing,Frequency division multiplex, Time – division multiplex, **Short and Medium Haul Systems**: Co-axial Cables, Fiber optic links, Microwave links, **Long Haul Systems**: Satellite Communications, **Elements of Long-Distance Telephony**, Routing codes and signaling systems, Telephone exchanges (switches) and routing.

UNIT IV *Text Book - 3* **(12)**

FUNDAMENTALS OF TELEVISION

Television Fundamentals: TV transmitter and receivers, synchronization, image continuity, interlaced scanning, flicker, picture resolution, horizontal and vertical sync details, number of scanning lines, scanning sequence details.

Essentials of colour television:colour perception, three colour theory, luminance, hue, saturation, colour difference signals.

UNIT V *Text Book - 1* **(12)**

OPTICAL COMMUNICATIONS

History and development, **nature of light:**reflection, refraction, dispersion, diffraction, absorption, scattering, Optical fiber losses, fiber cables, types of fibers.

TEXT BOOKS:

1. George Kennedy-Electronic Communication Systems -Tata McGraw-Hill Publishing , 5th Edition,2011
2. Simon HykinS, Communication Systems, 2nd Edition-reprint 2010
3. R.R. Gulati -Modern Television Practice – Principles, Technology and Service-New Age International Publication, 2009.

REFERENCES:

1. Simon HykinS-Introduction to Analog and Digital Communication. 2007
2. John M Senior – Optical Fiber Communications – An imprint of Pearson Education- 3rd Edition- 2009

WEB RESOURCES:

http://web.engr.oregonstate.edu/~magana/ECE461-561/index.htm
http://www.ensc.sfu.ca/~jiel/courses/327/index.html
http://www.ece.utah.edu/~npatwari/ece5520/lectureAll.pdf
http://nptel.iitm.ac.in/syllabus/syllabus.php?subjectId=117105077

EE 404A	OPEN ELECTIVE NON-CONVENTIONAL ENERGY SOURCES	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To know the depletion rate of conventional energy resources and importance of renewable energy resources.
2. To know the importance of Energy Storage Devices.
3. To know alternate viable energy sources to meet the energy requirements.
4. To discuss about solar energy, wind energy, tidal energy and geothermal energy as alternate resources.

COURSE OUTCOMES:

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

a. Know the national scene of energy production, utilization, consumption and energy storage systems.
b. Understand about the basics of solar energy, collectors & generation of electricity from solar energy &photovoltaic's.
c. Understand the assessment of wind energy potential, wind turbines and wind generators.
d. Know about ocean energy, temperature differences & principles, extraction of energy from waves.
e. Understand about geothermal, types & how biogas is produced & digester for power generation.

UNIT- I [*Text Book- 1&2]* **(12)**

Principle of Renewable Energy: Comparison of renewable and conventional energy sources - Ultimate energy sources - natural energy currents on earth - primary supply to end use - Spaghetti & Pie diagrams - energy planning - energy efficiency and management.

Energy Storage Systems: Pumped Hydro- Compressed air storage-Energy storage by fly wheels-Electrical battery storage-Thermal sensible energy storage-Latent heat energy storage.

UNIT II [*Text Book- 2, Ref Book- 1*] **(12)**

Solar Energy: Extra terrestrial solar radiation - terrestrial solar radiation - solar thermal conversion-solar thermal central receiver systems, Solar pond, Distributed systems.

Photovoltaic's: Photovoltaic energy conversion - solar cell- Construction- conversion efficiency & output-VI characteristics.

UNIT III *[Text Book- 2]* **(12)**

Wind energy: Planetary and local winds - vertical axis and horizontal axis wind mills.

Principles of wind power: maximum power – actual power - wind turbine operation - electrical generator.

UNIT IV *[Ref Book- 1]* **(12)**

Energy from Oceans: Ocean temperature differences - principles of OTEC plant operations.

Wave energy: devices for energy extraction - tides - simple single pool tidal system, two pool tidal system.

UNIT V *[Ref Book-1, Text Book- 1]* **(12)**

Geothermal Energy: Origin and types: Hydrothermal, Geo-pressurized & Petro thermal.

Bio fuels: Classification – direct combustion for heat and electricity generator - anaerobic digestion for biogas - biogas digester - power generation.

LEARNING RESOURCES

TEXT BOOKS:

1. JohnTwidell& Toney Weir"**Renewable Energy Sources**" E&F.N. Spon
2. EL-Wakil"**Power Plant Technology**" McGraw-Hill Publications.

REFERENCE BOOKS:

1. G.D.Rai"**Non-Conventional Energy Sources**"Khanna Publishers.
2. Abbasi&Abbasi"**Renewable Energy Sources**" Their impact on global warming and pollution by –PHI.

WEB REFERENCES:

1. http://www.tn.gov.in/spc/tenthplan/CH_11_2.PD
2. http://bieap.gov.in/Nonconventionalenergysources
3. http://www.em-ea.org/Guide%20Books/book4/4.12App%20of%20Non%20conventional

EE 404B	OPEN ELECTIVE UTILIZATION OF ELECTRICAL ENERGY	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To know about the different types of lamps & lighting schemes.
2. To know about the different types electric heating methods.
3. To know the design heating elements such as furnaces and ovens.
4. To know to utilize the electrical energy for production of heat and welding process.
5. To provide specific knowledge on Principles and characteristics of storage batteries

COURSE OUTCOMES:

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

a. To give the overall idea for the different types of lamps & lighting schemes.
b. To know about the different types electric heating methods.
c. To know the designing of heat elements such as furnaces and ovens.
d. To know how to utilize the electrical energy for production of heat and welding process.
e. To gain knowledge on principles and characteristics of storage batteries.

UNIT I *[Text Book- 1]* **(12)**

Illumination:

Introduction- terms used in illumination-laws of illumination-Square law methods of calculation.

Gas discharge lamps - Fluorescent lamps - Arc lamps - Filament lamps -Comparison between filament and fluorescent lamps.

UNIT II *[Text book-1]* **(12)**

Lighting schemes & Introduction to Electric heating:

Factory lighting - flood lighting and street lighting-design of lighting schemes-introduction to Compact Fluorescent Lamps.

Introduction-Modes of heat transfer - Stefan's law-Classification of electric heating methods

UNIT III *[Text Book- 1]* **(12)**

Electric Heating element Design and types of furnaces:

Design of heating element -Construction and working of different types of induction furnaces -resistance furnace - arc furnaces.

Dielectric heating, Dipole formation, generation of dielectric heat and applications.

UNIT IV *[Text Book- 1]* **(12)**

Welding: Introduction- Types of welding - resistance and arc welding -Characteristics of Carbon and metallic arc welding – comparison, welding equipment.

Requirements of good weld, comparisons of A.C and D.C weld(Excluding electronic controls)

UNIT V *[Text Book - 2]* **(12)**

Storage batteries:

Types of cells. Lead acid cell, Nickel Iron cell, Chemical changes during charging and discharging.Applications-rating-classification-dry cell and wet cells.

Methods of charging & common troubles: Charging and discharging of lead acid cells,-methods of charging lead acid batteries-over discharging common troubles with lead acid batteries and remedies-Nickel cadmium batteries.

LEARNING RESOURCES:

TEXT BOOKS:

1. J.B. Gupta -"Utilization Electric Power and Electric Traction", Katson books publishers, Tenth Edition, 2012.
2. Utilization, generation & conservation of electrical energy by Sunil S Rao, Khanna publishers, Sixth Edition, 2005.

REFERENCE BOOKS:

1. Partab H –"Art and Science of Utilization of Electrical Energy", Dhanpat Rai and Sons,
   New Delhi, Second Edition,2009.
2. R.K.Rajput-"Utilization of Electric Power", Laxmi publications Private Limited, Second Edition, 2013.
3. G.C.Garg –"Utilization of Electric Power and Traction", Kanna publishers, Ninth Edition, 2014.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/video.php?subjectId=108105060.
2. http://web.mit.edu/lien hard/www/ahttv201.pdf..
3. http://www.comp-as.com/pdf/Article03.pdf.
4. www.srmuniv.ac.in/downloads/welding.doc.
5. http://www.freesunpower.com/batteries.php.
6. http://www.trifield.com/content/fixing-common-static-problems/

IT 404A	OPEN ELECTIVE SOFTWARE ENGINEERING	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

At the end of the course the students will understand

1. Basic concepts on Software Engineering methods and practices.
2. Software Process Models and Software Development Life Cycle.
3. Requirements analysis and design of software development.
4. Software Development life cycle for Web app.

COURSE OUTCOMES:

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

a. Identify, formulate, and solve Software Engineering problems.
b. Elicit, analyze and specify software requirements for various stakeholders.
c. Familiar with Design, development, deployment and maintenance of a software project.
d. Familiar with Architecture design and User Interface design
e. Apply software engineering paradigms to web apps.

UNIT I **(12)**

INTRODUCTION TO SOFTWARE ENGINEERING: The Evolving Role of Software, Software, The Changing Nature of Software, Legacy Software, Software Myths.

A GENERIC VIEW OF PROCESS: Software Engineering - A Layered Technology, A Process Framework, The CMMI, Personal and Team Process Models.

UNIT II **(12)**

PROCESS MODELS: The Waterfall Model, Incremental Process Models, Evolutionary, Agile Process Model.

SOFTWARE ENGINEERING PRACTICE: Software Engineering Practice, Communication Practices, Planning Practices, Modeling Practices, Construction Practice, Deployment.

UNIT III **(12)**

REQUIREMENTS ENGINEERING: A Bridge To Design and Construction, Requirements Engineering Tasks, Initiating the Requirements Engineering Process, Eliciting Requirements, Developing Use-cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

DESIGN ENGINEERING: Design within the Context of Software Engineering, Design Process and Design Quality, Design Concepts, The Design Model.

UNIT IV **(12)**

CREATING AN ARCHITECTURAL DESIGN: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design.

PERFORMING USER INTERFACE DESIGN: The Golden Rules, User Interface Analysis

and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT V **(12)**

INITIATING A WEBAPP PROJECT: Formulating Web-Based systems, Planning for Web Engineering projects

ANALYSIS FOR WEBAPPS: Requirements Analysis for WebApps, Analysis Model for WebApps, The Content Model, The Interaction Model.

Learning Resources:

TEXTBOOKS:

1. Roger S.Pressman, 'Software Engineering- A Practitioner's Approach', 6th Edition, McGraw- Hill International, 2009.

REFERENCE BOOKS:

1. Ian Sommerville, 'Software Engineering', 6th Edition, Pearson Education, 2014.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, 'Fundamentals of Software Engineering', 2nd Edition, PHI,2002.
3. RajibMall, 'Fundamentals of Software Engineering', 3rd Edition, PHI, 2013.

IT 404B	OPEN ELECTIVE WEB TECHNOLOGIES	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

At the end of the course the students will understand
1. Basic technologies to develop web documents.
2. Design web pages with css and apply scripting to web documents.
3. Design dynamic web pages with javascript.
4. Concepts of xml.
5. Concepts of php and database access.

COURSE OUTCOMES:

At the end of the course the students will be able to
a. Apply technologies to develop web documents.
b. Design web pages with css and apply scripting to web documents.
c. Create dynamic web pages with javascript.
d. Create valid and well-formed xml documents.
e. Write server side scripts with php and database access.

UNIT I **(12)**

Fundamentals: A Brief introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Multipurpose Internet Mail Extensions, The HTTP.

Introduction to XHTML: Origins and evolution of HTML, and XHTML, Basic Syntax, Standard XHTML, Document structures, Basic Text markup, images, hypertext links, lists, tables, forms, frames, syntactic differences between HTML & XHTML.

UNIT II **(12)**

Cascading Style Sheets (CSS): introduction, levels of style sheets, style specification formats, selector forms, property value forms, font properties, list properties, color, alignment text, The Box model, Background images, the span and div tags.

The Basics of JavaScript: Overview of JavaScript, Object orientation and JavaScript, General Syntactic characteristics, primitives, operations and expressions, Screen output and keyboard input, control statements.

UNIT III **(12)**

JavaScript: Object creation and modification, Arrays, Functions, An Example, Constructors, Pattern matching using regular expressions, Errors in scripts.

JavaScript and HTML Documents: The JavaScript Execution Environment, The Document Object Model, Element accessing in JavaScript, Events and Event Handling, Handling Events from Body elements, Handling events from Button elements, Handling Events from Text boxes and password elements, The DOM 2 Event model, The Navigator object.

UNIT IV (12)

Dynamic Documents with JavaScript: Introduction, Element Passing, Moving Elements, Element Visibility, Changing colors and Fonts, Dynamic Content, Stacking Elements, Locating the mouse cursor, Reacting to mouse click, slow movement of elements, dragging and dropping elements.

Introduction to XML: Introduction, The syntax of XML, XML document structure, Document Type Definition, Namespaces, XML Schemas, Displaying Raw XML documents, displaying XML documents with CSS, XSLT Style sheets.

UNIT V (12)

Introduction To PHP: Origins and uses of PHP, Overview of PHP, General Syntactic Characteristics, primitives, Operations and Expressions, Output, Control Statements, Arrays, Functions, Pattern Matching, Form Handling.

Database Access through the web: Relational Databases, An Introduction to the Structured Query Language, The MYSQL Database System, Database Access with PHP and MYSQL.

Learning Resources:

TEXT BOOK:

1. Robert W. Sebesta "Programming the World Wide Web", 4/e Pearson Education.

REFERENCE BOOKS:

1. Harvey M. Deitel and Paul J. Deitel, "Internet & World Wide Web How to Program", 5/e, Pearson Education.
2. Jeffrey C. Jackson Web Technologies - A Computer Science Perspective, Pearson Education, 1st Edition.
3. Jason Cranford Teague, Visual Quick Start Guide CSS, DHTML & AJAX, Pearson Education, 4th Edition.

WEB REFERENCES:

- www.wikipedia.com
- www.w3schools.com
- http://nptel.iitm.ac.in

ME 404A	OPEN ELECTIVE ROBOTICS	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To provide an introduction to Robotics and Automation including robot classification, design and selection, analysis and applications in industry.
2. To provide information on various types of end effectors, their design, interfacing and selection.
3. To provide the details of operations for a variety of sensory devices that are used on robot , the meaning of sensing, classification of sensor, that measure position, velocity & acceleration of robot joint.
4. The goal of the course is to familiarize the students with the basic concepts of transformations performed by robot.
5. Familiarize students to perform kinematics and to gain knowledge on programming of robots.

COURSE OUTCOMES:

a. At the end of the course, students will be familiarized in basic components of robotics, classification of robots and their applications.
b. They will have knowledge on types of robot grippers, their usage and design considerations.
c. They attain knowledge on various types of sensory devices their working and applications.
d. Students will apply basic transformations related to the movement of manipulator.
e. An ability to design a robot mechanism to meet kinematics requirements and to write simple programs.

UNIT I **(12)**

Basics of Robot: Introduction to Robotics, major component of a robot, robotic like devices, classification of robots - Classification by coordinate system and by control method, Specifications of robots, fixed versus flexible automation.

Applications of robot: Economic analysis, Robot applications in Material Handling, Processing and assembly.

UNIT II **(12)**

Robot End Effectors: Introduction, end effectors, interfacing, types of end effectors, grippers and tools.

Selection: Selection and Design Considerations of End effectors, Remote Centre Compliance device.

UNIT III **(12)**

Robotic Sensory Devices:

Position Sensors: Objective, Non-optical position sensors - potentiometers, synchros, inductocyn, optical position sensors – opto interrupters, optical encoders (absolute & incremental).
Proximity Sensors: Contact type, non-contact type – inductive, capacitive proximity sensors, optical proximity sensor, and scanning laser proximity sensor.

UNIT IV (12)
Touch and Slip Sensors: Proximity rod & photo detector tactile sensor, slip sensors - Forced oscillation slip sensor, interrupted type slip sensors.
Transformations: Objectives, homogenous coordinates, basic transformation operations, fixed angle representation, Euler angle representation.

UNIT V (12)
Forward Kinematics: Forward solution – Denavit Hartenberg procedure. Simple problems involving 2 and 3 DOF manipulators, SCARA manipulator.
Robot Programming: Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs.

LEARNING RESOURCES

TEXT BOOKS:

1. Robotic Engineering by Richard D.Klafter, Prentice-Hall of India Pvt Ltd, 2010.
2. Industrial Robotics by Mikell P. Groover, Tata McGraw-Hill Int. Edition 2, 2012.
3. Robotics and Control, R.K. Mittal and I.J. Nagarath, TMH, 2005[4 UNIT- 1st chapter].

REFERENCE BOOKS:

1. Introduction to Robotics: Mechanics And Control, John J.Craig 3rd Edition, Pearson, 2008.
2. Robotics: Control, Sensing, Vision, and Intelligence, K. S. Fu, R. C. Gonzales, and C. S. G. Lee, Tata McGraw-Hill, NY, 2008.
3. Introduction to Robotics: Analysis, Systems, Applications, Saeed B. Niku, Prentice Hall, NJ, 2010.

WEB REFERENCES:

- http://nptel.iitm.ac.in/courses.php?branch=Mechanical
- http://academicearth.org/courses/introduction-to-roboticsVideo references:-

ME 404B	OPEN ELECTIVE OPERATIONS RESEARCH	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Grasp the methodology of OR problem solving and formulate linear programming problem.
2. Develop formulation skills in transportation models and finding solutions
3. Understand the basics in the field of game theory and assignment problems
4. Be able to know how project management techniques help in planning and scheduling a project
5 Be able to know the basics of dynamic programming and simulation.

COURSE OUTCOMES:

a. Recognize the importance and value of Operations Research and linear programming in solving practical problems in industry
b. Interpret the transportation models' solutions and infer solutions to the real-world problems.
c. Recognize and solve game theory and assignment problems.
d. Gain knowledge of drawing project networks for quantitative analysis of projects
e. Know when simulation and dynamic programming can be applied in real world problems.

UNIT I **(12)**

Linear Programming : Definition and Scope of Operations Research, Mathematical formulation of the problem, graphical method, Simplex method, artificial basis technique, dual Simplex method. Degeneracy, alternative optima, unbounded solution, infeasible solution.

UNIT II **(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 problem and Maximization in transportation model.

UNIT III **(12)**

Assignment Problem: One to one assignment problem, optimal solutions, unbalanced assignment matrix, travelling sales man problem, maximization in A.P.

Theory of Games: Introduction, rectangular two person zero sum games, solution of rectangular games in terms of mixed strategies, solution of 2x2 games without saddle point, concept of dominance to reduce the given matrix, Graphical method for 2xn and nx2 games.

UNIT IV (12)

Project Planning through Networks: Introduction, Basic steps in PERT/CPM techniques, Network diagram representation, Rules of drawing network diagram, Fulkerson's rule, Time estimates and Critical path in network analysis, floats, Project evaluation and review technique, Application areas of PERT/CPM techniques.

UNIT V (12)

Dynamic Programming: Introduction, Characteristics of D.P. model, the recursive equation approach, Computational Procedure in dynamic Programming, solution of an L.P. by D.P

Simulation: Introduction, Monte-Carlo Simulation, Application to Inventory Control, Application to Queuing Problems

LEARNING RESOURCES

TEXT BOOKS:

1. Operations Research - S.D. Sharma, Kedarnath Ram nath & Co, 2008.
2. Operations Research - Theory and Applications ,J.K Sharma, Macmillan Publications India Ltd, 2013

REFERENCES

1. Operations Research - H.A. Taha , Pearson , 7th Edition, June 2002.
2. Introduction to Operations Research - Hiller and Liberman, MGH, 7th Edition, 2002.

WEB REFERENCES :

- http://www2.informs.org/Resources/
- http://www.mit.edu/~orc/
- http://www.ieor.columbia.edu/
- http://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.htm
- http://www.wolfram.com/solutions/OperationsResearch/

ME 405	OPERATIONS MANAGEMENT	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To know the importance of forecasting and identify various methods available to forecast the sales/demand
2. Get the knowledge of choosing best location for plants
3. To learn about the aggregate planning and its methods
4. Explain the importance of materials management and inventory control
5. Discuss the network techniques and features of project management
6. To learn about the significance of supply chain management.

COURSE OUTCOMES:

a. Understand the role of forecasting, its importance in industry and apply the techniques to estimate the sales/demand
b. Solve operations and project management problems
c. Analyze aggregate production planning and determine a cost effective production plan
d. Solve project sequencing problem using different sequencing techniques
e. Recognize the importance of Inventory control to ensure their availability with minimum capital lock up.
f. Understand and construct a network to determine project duration times
g. Understand the purpose of Supply chain management to improve the overall organization performance and customer satisfaction

UNIT I **(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. Introduction to line balancing.

UNIT II **(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 III **(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 IV (12)

Inventory Control: purpose of inventories, types of inventories, relevant costs in inventory control, Deterministic continuous review models: Basic EOQ, Economic production quantity model, Basic EOQ model with shortages, Re-order point and safety stock. ABC and VED analysis.

Materials Management and MRP: Functions of materials management, Materials requirement planning (MRP): Importance of MRP and CRP, MRP system inputs and outputs, bill of materials, MRP logic.

UNIT V (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.

Supply Chain Management: Introduction, need for supply chain management, Elements of supply chain management, Logistics, E-commerce, Steps in creating an effective supply chain, supplier management.

LEARNING RESOURCES

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Materials Management – Gopalakrishnan and Sudhakaresan.
2. Operations Research – R.Pannerselvem, PHI, 2nd edition,2006.
3. PERT and CPM : Principles and applications- L.S.Srinath, Natraj publishers, 2009.

WEB REFERENCES:

- http://nptel.iitm.ac.in/
- www.learnerstv.com/Free-Engineering-video-lecture-courses.htm
- http://www.apics.org/
- http://www.bized.co.uk/fme/5.htm

ME 406A	ELECTIVE IV MECHATRONICS	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Appreciate its relevance to contemporary engineering design and to identify a mechatronics system
2. Understand data acquisition, quantization theory and AD & DA conversion.
3. Know various components and applications of pneumatic, hydraulic actuation systems and principle of operation of various types of stepper motors.
4. Construct various one and two degree of freedom mechanical, electrical, fluid and thermal systems and construct block diagrams for various systems.
5. Understand various components and control modes of closed loop control systems
6. Know the architecture, programming and application of programmable logic controllers.
7. Understand design aspects of mechatronics system and demonstrate the cases studies of mechatronics system like pick and place robot.

COURSE OUTCOMES:

a. Demonstrates how mechatronics integrates knowledge from different disciplines in order to realize engineering and consumer products that are useful in everyday life.
b. Select suitable actuators and sensors and integrate them with embedded control computers.
c. Select appropriate transducer signal conditioning devices for data conversion including operational amplifiers for analogue signal processing.
d. Builds a system model for mechanical, electrical, thermal and fluid power systems.
e. Explains various modes of operation of closed loop controllers.
f. Explains the architecture and programming of programmable logic controllers.
g. Designs a mechatronics system.

UNIT I **(12)**

Introduction to Mechatronics: sensors & transducers: Introduction, performance terminology, classification of sensors, selection of sensors.

Signal Conditioning: Introduction data acquisition - Quantizing theory, analog to digital conversion, digital to analog conversion.

UNIT II **(12)**

Data Presentation Systems: Data presentation elements magnetic displays, data acquisition systems, systems measurement, testing and calibration.

Actuation Systems: Pneumatic and hydraulic actuation systems, stepper motors.

UNIT III **(12)**

System Models: Modelling of one and two degrees of freedom mechanical, electrical, fluid and thermal systems. Block diagram representations for these systems.
Closed Loop Controllers: Continuous and discrete processes control modes, two step, proportional, and derivative, integral, and PID controllers.

UNIT IV (12)

Dynamic Response of systems zero order, First order and second order systems. Block diagram representation.
Transfer function. Systems in series, Systems with feedback loops, frequency response

UNIT V (12)

PLC: Introduction, basic structure, I/P, O/P, processing, programming, ladder diagrams, timers, internal relays and counters, data handling, analogue input and output selection of PLC.
Design: Designing mechatronics systems, possible design solutions, case studies of mechatronics systems - pick and place robot.

LEARNING RESOURCES

TEXT BOOK:

1. Mechatronics by W.Bolton , (Pearson) , 4th Edition , 2011.

REFERENCE BOOKS:

1. Mechatronics: principles , concepts and applications, by Mahalik , MGH , 2003.
2. Introduction to Mechatronics - David and Alcaitore Michael B.Histand (TMH), 2007.
3. Mechatronics By G.Onwubolu -Elsevier., Edition 1 , 2005.

COURSE RELEVANT WEB SITES FOR REFERENCE

- *http://ocw.mit.edu/*
- *http://nptel.iitm.ac.in/*

ME 406B	ELECTIVE IV DESIGN FOR MANUFACTURING AND ASSEMBLY	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Introduce the concepts of design for manufacturability for optimal manufacturing processes and layouts for economical batch production.
2. To introduce various machining and casting processes and various design considerations in machining and casting of various components.
3. To provide knowledge on weld ability of products, various welding processes, design considerations in welding.To provide knowledge on forging, various types of forging, forging design considerations and forging die design.
4. The provide knowledge on processes such as extrusion, deep drawing, punching and blanking operations. To introduce the applicability of plastic materials in manufacturing.
5. To provide knowledge on various types

COURSE OUTCOMES:

a. Able to apply the concepts to select appropriate materials, manufacturing processes and layouts for economical batch production.
b. Fabricate and manufacturing mechanical components using non machining operations.
c. Gains knowledge on various design factors and recommendations during welding and forging.
d. Gains sufficient knowledge on deep drawing, blanking, punching and extrusion.
e. Able to identify various automated assembly approaches and their applications

UNIT I **(12)**

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.

Materials: Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

UNIT II **(12)**

Machining processes: Overview of various machining processes general design rules for machining-dimensional tolerance and surface roughness-Design for machining - ease -redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

Metal casting: Appraisal of various casting processes, selection of casting process,- general design considerations for casting-casting tolerance-use of solidification, simulation in casting design product design rules for sand casting.

UNIT III (12)

Metal joining: Appraisal of various welding processes factors in design of weldments - general design guidelines-pre and post treatment of welds effects of thermal stresses in weld joints-design of brazed joints.

Forging: Design factors for forging - closed die forging design - parting lines of dies - drop forging die design - general design recommendations.

UNIT IV (12)

Extrusion & Sheet metal work: Design guide lines extruded sections design principles for punching, blanking and deep drawing-Keeler Goodman forging line diagram - component design for blanking.

Plastics: Visco elastic and creep behaviour in plastics-design guidelines for plastic components design considerations for injection moulding - design guidelines for machining and joining of plastics.

UNIT V (12)

Assemble Advantages: Development of the assemble process, choice of assemble method assemble advantages social effects of automation.

Automatic Assembly Transfer Systems: Continuous transfer, intermittent transfer, indexing mechanisms, and operator - paced free – transfer machine.

LEARNING RESOURCES

TEXT BOOKS:

1. Design for manufacture, John cobert, Adisson Wesley. 1995
2. Product Design for Manufacturing and Assembly/ Geoffrey Boothroyd, Peter Dewhurst & Winston Ansthony Knight/CRC Press/2010

REFERENCES:

1. Engineering Design - Material & Processing Approach/ George E. Deiter/McGraw Hill Intl. 2nd Ed. 2000.
2. Hand Book of Product Design/ Geoffrey Boothroyd/ Marcel and Dekken, N.Y. 1990.
3. Computer Aided Assembly London/ A Delbainbre/.

WEB RESOURCES:

- *www.casde.iitb.ac.in/store/events/2003/IAT-Pune.../DFMA.ppt*
- *www.rose-hulman.edu/~stienstr/ME470/DFA.ppt*
- *www.design4manufacturability.com/DFM_article.htm*

ME 406C	ELECTIVE IV ENERGY RESOURCES UTILIZATION	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Students will be able to understand basic principles and operation of power plants. They can evaluate the factors on which a site can be finalized.
2. Students will be able to understand the need for various systems used in power plants. They will be able to explain the cycles on which these plants operate.
3. The student is made to understand the necessity for going for nuclear power plants.
4. They can explain the various factors of load demand and consumption and identify the various costs involved in operating a power plant. They can calculate the expenditure incurred for setting up the plant and running it.
5. The student learns that solar energy available almost throughout the year in many places on earth and wind power systems play an important role in the overall power production.

COURSE OUTCOMES:

a. Distinguish the differences among the variety of power plants.
b. Explain the principles of operation of the power plants.
c. Identify the places where a plant of a particular type can be set up.
d. Explain the need for various types of assemblies required in a power house.
e. Explain the importance of a non conventional energy resources.

UNIT I **(12)**

Introduction: Various Energy sources, types of power plants.

Hydro Electric Power Plant: Hydrology, Rainfall, Run off and their measurement, hydrograph, Flow duration curve, Mass curve and calculation of storage capacity, site selection of hydro plant, different types of hydro plants.

Diesel and Gas Turbine Power Plants: Classification, main components of plant, plant layout, application and comparison with other plants.

UNIT II **(12)**

Thermal Power Plant:

General layout, Fuels, Coal analysis, Coal handling, burning of coal - stoker and pulverized systems, Ash handling systems, ESP, Need for Draught High-pressure boilers, cooling ponds and towers (wet and dry types), Deaeration.

UNIT III **(12)**

Nuclear Power Plants: Nuclear Fission, Nuclear Fuels, Components of Reactor, types of Nuclear Reactors, Breeding, Fast Breeder Reactor, Radiation shields, nuclear waste disposal.

Fluctuating Loads on Power Plants and Power Plant econimics : Various performance Factors (load factor, diversity factor, use factor etc.). Fixed costs, operating costs, cost per kWh, comparison of fixed and operating costs of hydro, thermal, nuclear plants, power tariffs.

UNIT IV **(12)**

Solar Energy: Solar collectors, solar energy storage, solar ponds, solar energy utilization and applications.

Wind Power: Basic principle, different types of wind mills, wind energy conversion systems, other applications.

Geothermal Power: sources, energy conversion system

UNIT V **(12)**

Introduction to tidal power: Ocean energy sources, Tidal power plants, Wave energy, Ocen Thermal Energy conversion (OTEC) system

Direct Energy Conversion Systems: Fuel cells, MHD, Solar cell.

Pollution and Control: Introduction, particulate and gaseous pollutants, thermal pollution and solid waste pollution, methods to control pollution - brief description.

TEXT BOOKS:

1. A course in Power plant Engineering - ARORA & DOMKUNDWAR , Dhanpat Rai & Co.
2. Power Plant Engineering - G.R. Nagpal, Khanna publ, New Delhi
3. Power Plant Engineering –P.K.Nag, TMH
4. Non Conventional Energy Sources - G.D. Rai, Khanna publ, New Delhi.
5. Power Plant Engineering - G.D. Rai, Khanna publ, New Delhi.

REFERENCE BOOKS:

1. Power Plant Technology - M.M. El Wakil, MGH, New York.
2. Principles of Energy Conversion - A.W.Culp, MGH, New York.

WEB REFERENCES

- *www.wikipedia.com*
- *NPTEL Lectures (IIT M)*
- *www.knowhow.com*

ME 406D	ELECTIVE IV SAFETY MANAGEMENT	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To achieve an understanding of principles of safety management.
2. To enable the students to learn about various functions and activities of safety department.
3. To enable students to conduct safety audit and write audit reports effectively in auditing situations.
4. Understand the way of investigating the accidents and prepare the reports.
5. To have knowledge about sources of information for safety promotion and training.
6. To familiarize students with evaluation of safety performance.

COURSE OUTCOMES:

a. To understand the functions and activities of safety engineering department.
b. To carry out a safety audit and prepare a report for the audit.
c. To prepare an accident investigation report.
d. To estimate the accident cost using supervisors report and data.
e. To evaluate the safety performance of an organization from accident records.
f. To identify various agencies, support institutions and government organizations involved in safety training and promotion.

UNIT I (12)

Concepts

Evolution of modern safety concept- Safety policy - Safety Organization – line and staff functions for safety- Safety Committee- budgeting for safety.

UNIT II (12)

Techniques

Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

UNIT III (12)

Accident Investigation and Reporting

Concept of an accident, reportable and non reportable accidents, unsafe act and condition – principles of accident prevention, Supervisory role- Role of safety committee - Accident causation models - Cost of accident. Overall accident investigation process - Response to accidents, India reporting requirement, Planning document, Planning matrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents, accident reports-Class exercise with case study.

UNIT IV (12)

Safety Performance Monitoring

permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, freequency severity incidence, incident rate, accident rate, safety "t" score, safety activity rate – problems.

UNIT V (12)

Safety Education and Training

Importance of training-identification of training needs-Training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training – safety training to workers.

Text Books :

1. Subramanian.V., *"The Factories Act 1948 with Tamilnadu factories rules 1950"*, Madras Book Agency, 21st ed., Chennai, 2000.
2. C.Ray Asfahl *"Industrial Safety and Health management*" Pearson Prentice Hall,2003.
3. National Safety Council, *"Accident Prevention Manual for Industrial Operations"*, N. S. C. Chicago, 1988.
4. Heinrich H.W. *"Industrial Accident Prevention*" McGraw-Hill Company, New York, 1980.
5. Krishnan N.V. *"Safety Management in Industry*" Jaico Publishing House,Bombay, 1997.
6. John Ridley, *"Safety at Work*", Butterworth & Co., London, 1983.
7. Blake R.B., *"Industrial Safety*" Prentice Hall, Inc., New Jersey, 1973

WEB RESOURCES:

- http://www.enetosh.net/files/186/iag_standard_en.pdf
- https://support.dce.felk.cvut.cz/psr/prednasky/safety/safety-intro.pdf

ME 451	MINI PROJECT/ INDUSTRIAL TRAINING/ TERM PAPER	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

1. To make the graduate become an affective communicator.
2. To prepare graduates to express the knowledge they have gained in the areas related to Mechanical Engineering.

COURSE OUTCOMES:

a. The graduate shall be able to express problem to be solved, the method to solve the problem and the analysis done on the problem.
b. The student will be able to know the latest tools available to get the solution of a given problem.

INSTRUCTIONS :

- Internal marks will be awarded based on the SEMINAR presentations on their Project Aim.
- The students of the IV Year first semester are assigned mini-projects.
- The students have to study industry related or theoretical topics, which enable them to know about the real time problems.
- The progress of the work will be monitored by the coordinators, who are usually senior faculty members.
- The Mini Project/ Industrial Training/ Term Paper presentation and it will be evaluated at the end of the semester based on the report and presentation and internal marks will be awarded.
- There is no end semester examination.

ME 452	SIMULATION LAB	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

1. To get familiarize with MATLAB Programming
2. To do simple exercises on Numerical methods
3. To learn the design of a system with models
4. To find the dynamic stability of structures using MATLAB

COURSE OUTCOMES:

On learning this course students will be able to

a. do programming on MATLAB
b. To find solutions of Mechanical Engineering Problems in an effective way
c. To support the Project using MATLAB software.

Any 6 Experiments from programing and any 4 from Simulink using MATLAB .

Programing Exercises:

1. Introduction to matlab, fundamentals of programing
2. Using gauss elimination to solve equations
3. Newton Raphson method to estimate the root of given equation
4. Implementation of RK method for ordinary differential Equations
5. Plot the displacement, velocity and accelerationsvs angle for a slider crank mechanism.
6. Computing Forces on a Truss using method of joints
7. Free-vibration response of a damped single-degree of freedom system
8. Free-vibration response of a two-degree of freedom system
9. Forced-vibration response of a damped single-degree of freedom system

Simulation Exercises:

10. Spring mass system using simulink.
11. Build a Simulink model of a bouncing ball.
12. Simulating a fourbar mechanism
13. Hydraulic Circuit with Single-Acting Cylinder
14. Flyball Governor
15. Automotive Suspension

ME 453	DESIGN AND METROLOGY LAB	L	T	P	M	C
		-	-	3	100	2

COURSE OBJECTIVES:

1. To impart the knowledge regarding importance of accuracy & precision while taking 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:

a. Identify the importance alignment of machine tools
b. Gain the knowledge about various design principles practically
c. Acquire the working/ operation of various types of dynamometers.

Any Ten Experiments should be performed:

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
15. Governor
16. CAM Analysis
17. Photo elastic Bench
18. Wear & Friction measurement
19. Measurement of cutting forces using lathe tool dynamometer
20. Measurement of cutting forces using drill tool dynamometer

ME 407	INDUSTRIAL ENGINEERING & MANAGEMENT	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. It aims to provide the students with an understanding of basics of productivity, work study& method study
2. To know the tools which are used for recording information while preparing flow process charts.
3. Students are exposed to principles of motion economy techniques to enhance the productivity of our regular day to day life activities.
4. Students are exposed to know the importance of Ergonomics
5. It aims to provide a basic insight into various Factory acts, wage and incentive systems.
6. Provide an understanding of personnel management.
7. It aims to provide the students with an understanding of concept of marketing and an insight into break-even analysis and product life cycle.
8. To know the depreciation and its methods of measuring depreciation.
9. To know the components in calculating the manufacturing cost of a product.

COURSE OUTCOMES:

a. Able to understand concepts of productivity and know the ways of enhancing productivity.
b. Acquire working knowledge of how to find the best method of doing a job and arrange a work place more productively.
c. Appreciate the importance of work sampling and differentiate between time study and work sampling.
d. Describe the role and responsibilities of management in organization
e. Differentiate the structures of various organization systems
f. Understand the concept of job design and analysis.
g. Develop ability to understand various marketing strategies to enhance sales promotion.
h. Develop the skills to estimate the product cost and fixing its selling price.

UNIT I (12)

Productivity: Definition, methods to measure productivity, Measures to improve productivity, Management techniques to reduce work content and ineffective time.
Work study: Introduction, techniques of work study, Advantages of work study. Method Study- Procedure, Tools for recording information: charts and diagrams; use of fundamental hand motions (Therbligs), principles of motion economy, SIMO chart, cycle graph and chrono cycle graph.

UNIT II (12)

Work Measurement: Objectives and techniques, time study procedure and rating systems. Allowances: Standard and allowed time.

Work sampling: Activity sampling, confidence levels, number of observations, use of random number tables, procedure for making a work sampling study and problems.

UNIT III **(12)**

General Management: Principles of scientific management, brief treatment of managerial functions: planning, organizing, staffing, directing, coordinating and controlling.

Personnel Management: Functions of a personnel manager, job analysis and job design, Job evaluation and Merit rating, Wages and Incentive plans, Factories act – Related to health, working hours, environment and working conditions, safety, employee welfare.

UNIT IV **(12)**

Marketing management: Concept of selling and marketing, Functions of marketing, Market research, advertising and sales promotion, break-even analysis, distribution channels – types, product life cycle.

Financial management: Functions of finance, simple and compound interest, depreciation, common methods of depreciation: straight line method, declining balance method, sum of year's digits method, Accountancy**:** Accounting principles, procedure- double entry system- journal- ledger, Trial balance- cash book-preparation of trading, profit and loss account-balance sheet.

UNIT V **(12)**

Estimation and Costing: Elements of cost, direct cost, indirect cost, fixed cost, variable cost, semi-variable cost, prime cost, manufacturing cost, overheads, allocation of overheads, determination of various costs, problems. Objectives and functions of estimating the cost.

Cost of machining operations such as tuning, drilling, boring, milling etc. cost of welding and casting.

TEXT BOOKS:

1. Introduction to work study – ILO , 1992
2. Engineering Economy – Theusen & Theusen , PHI , 2000
3. Fundamentals of Marketing – Williams J Stanton , Mc Grawhill
4. Personnel Management – Tripathi and Reddy , MH , 4th Edition
5. Operations Management – Joseph G.Monks , Schaums Outline series
6. Estimating and Costing – Narang and Kumar.
7. Arora, M.N. " Cost Accounting", Vikas publications.

COURSE RELEVANT WEB SITES FOR REFERENCE

- *www.knovel.com*
- *www.books.google.com*
- *www.igi-global.com*
- *www.wiley.com*
- *www.tectime.com*
- *www.exinfm.com*
- *www.slideshare.net*

- *www.economywatch.com*

ME 408	AUTOMATION & CAM	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Learn the principles of automation in integrating various operations and activities in a manufacturing plant to improve productivity.
2. Classification and Important concepts of numerical control systems.
3. Various principles of manual part programming for 2D components and computer assisted part programming in APT language.
4. Basic concepts of CIM, GT, CAPP, FMS.
5. Introduce the field of robotics, provide panoramic view evolution & perspective of robot, by describing major robot components & anatomy with control system along with applications.

COURSE OUTCOMES:

a. Comprehensive theoretical knowledge about modern machining processes
b. Ability to understand about automation and transfer lines
c. List the canned cycles available for each CNC machine.
d. The student should be able to explain the terminology used to describe CNC, DNC and adaptive control machine tools
e. Students will able to Prepare simple programs for CNC Turning and machining centers
f. Student able to understand the group technology, flexible manufacturing systems and computer aided process planning.

UNIT I **(12)**

Industrial Robotics: Introduction, robot anatomy, joints and links, common robot and configurations, joint drive systems, robot control systems, end effectors, sensors in robotics, applications of robots - material handling, processing, assembly and inspection.

UNIT II **(12)**

Automation: Automation in production systems – automated manufacturing systems, computerized manufacturing support systems, reasons for automating, merits and demerits, automation principles and strategies.

Manufacturing industries and products, manufacturing operations - processing and assembly operations, other factory operations.Computer Aided Process Planning:Introduction, retrievalCAPP system, generative CAPP systems, benefits of CAPP.

Introduction to Computer Integrated Manufacturing.

UNIT III **(12)**

Numerical Control : Introduction, basic components of an NC system, classifications of NC systems, nomenclature of NC machine axes, interpolation methods, features of CNC, the machine control UNIT for CNC, CNC software, direct numerical control,

distributed numerical control, applications of NC, advantages and disadvantages of NC, adaptive control machining.

UNIT IV (12)

NC Part Programming: NC coding systems, manual part programming, simple examples on drilling, milling and turning operations,
Computer assisted part programming, part programming with APT language, simple examples in drilling and milling operations.

UNIT V (12)

Group Technology & Cellular Manufacturing: Introduction, part families, parts classification and coding, features of parts classification of coding system, OPITZ , MICLASS, Product Flow Analysis, composite part concept, machine cell design, applications.
Flexible Manufacturing Systems: Introduction, types of FMS, components, FMS layout configurations, computer control system, human resources, applications and benefits.

LEARNING RESOURCES

TEXT BOOK:

1. Automation, Production systems and Computer Integrated Manufacturing by M.P.Groover, Pearson Education / PHI.

REFERENCE BOOKS :

1. CAD/CAM by M.P.Groover and E.W.Zimmers, Pearson Education / PHI.
2. CAD/CAM by P.N.Rao, TMH, , New Delhi, 2002
3. Advanced Manufacturing Technology [CAD/CAM] by K. Vara Prasada Rao, Khanna Publisher.

WEB REFERENCES

- http://www.cadcamfunda.com/cam_computer_aided_manufacturing
- http://wings.buffalo.edu/eng/mae/courses/460-564/Course-Notes/cncclassnotes.pdf
- http://www.me.nchu.edu.tw/~CIM/courses/Flexible%20Manufacturing%20Systems/Microsoft%20Word%20-%20Chapter7F-GT%20and%20FMS.pdf

ME 409A	ELECTIVE V FLEXIBLE MANUFACTURING SYSTEMS AND GROUP TECHNOLOGY	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To understand the basic concepts of FMS
2. To understand the different types of flexibilities associated with FMS
3. To understand the type of equipment used in FMS
4. To provide importance of tooling and various types of tool management systems.
5. To understand the various computer control systems of FMS
6. To understand the need for Group Technology as a means of bringing the benefits of mass production to the relatively smaller production that is required in a majority of present day manufacturing industries
7. To learn about the coding and classification methods and schemes used in manufacturing

COURSE OUTCOMES:

a. To get familiarize with the need and terminology associated with FMS
b. To have an idea of material handling and Different storage systems used in Manufacturing
c. To understand the FMS Control requirements
d. To have an idea of the integration of different automatic systems to enhance the quality of manufacturing
e. To apply GT Concepts in Manufacturing.

UNIT I **(12)**

INTRODUCTION: Manufacturing Automation, Definition and types of FMS, Architecture of FMS, Workpiece flow in FMS, Performance measures of FMS.
WORK STATION: CNC Machines, Machine Centres, Inspection Stations.

UNIT II **(12)**

AUTOMATED MATERIAL HANDLING: Function of MHS, Types of Material handling equipment, Conveyor systems, AGVs, Industrial Robots.
AUTOMATED STORAGE SYSTEMS: Characteristics of Storage Systems

UNIT III **(12)**

COMPUTER CONTROL SYSTEM OF FMS: Functions of Computer, Control system architecture, Factory level, Cell level control systems, Equipment control systems, Factory communications, Local area networks, Data files and system reports.

UNIT IV **(12)**

GROUP TECHNOLOGY: Introduction, need of G.T. Part families, Methods for developing part families, Basic type of Codes – hierarchical codes, Attribute code,

Hybrid code, selecting a coding system, Developing a coding system in an industry, examples of coding systems, MICLASS, OPITZ, CODE systems.

UNIT V **(12)**

Facility Design using, GT, Economic modeling in GT environment – production planning cost model, Economics of GT, Application of GT for design retrieval, CAPP, NIC, MR and FMS.

TEXT BOOK:

1. Automation, Production Systems and Computer Integrated Manufacturing by M.P.Groover.

REFERENCES:

1. Performance Modeling of Automated Manufacturing Systems ,N.Viswanadham, Y.Narahari.
2. CAD/CAM Handbook by Eric Teichloz.
3. Computer Integrated Design and Manufacturing by Bedworth Henderson, Wolfe.
4. CAD/CAM by Groover and Zimmers.

WEB REFERENCES:-

- http://me.emu.edu.tr/majid/IENG447/FMS.pdf
- http://www.slideshare.net/RanjeetKumar41/flexible-manufacturing-system
- http://www.slideshare.net/Nuumero1/group-technology-33437786
- http://www.slideshare.net/ShovonMallick41/group-technology-and-cellular-manufacturing

ME 409B	ELECTIVE V COMPUTER AIDED DESIGN	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. This topic gives information about the product life cycle, concepts of CAD software and its applications.
2. How CAD technology can be leveraged in the design process
3. Students will learn theory and practice parametric modelling related to analytical wire frame modelling.
4. Students will learn theory and practice parametric modelling related to synthetic wire frame modelling and surface modelling.
5. Assembling and drafting by using solid, modelling techniques.
6. Use of CAD models for downstream engineering activities such as manufacturing and finite element analysis.

COURSE OUTCOMES:

a. Use of computer Aided Design concepts for the creation of new entities in the database.
b. Use parametric modelling techniques to reflect engineering requirements.
c. Apply modelling techniques to enhance the design aspects.
d. Design a part or assembly of parts using computer aided design software. Apply top-down design principles to model a product.
e. Use motion and interference checking to ensure that parts will not interfere throughout their complete range of motion.

UNIT I **(12)**

Introduction: Application areas of computer graphics, Fundamentals of CAD, Design process, Applications of computer for design, Benefits of CAD, CAD work station, Graphic terminal, CAD software, CAD database and structure , Input Devices.

Display Devices: Video display devices, Raster scan systems, Random scan systems.

UNIT II **(12)**

Output Primitives: Points and Lines, Line drawing algorithms, DDA algorithm, Bresenham's line algorithm, Circle generation algorithm, Mid-point circle algorithm.

Geometric Modelling: 2D wire frame modelling, 3D Wire frame modelling, Wire frame models, Entities and their definitions. Concept of Parametric and nonparametric representation of curve, Curve fitting techniques.

UNIT III **(12)**

Representation of synthetic curves:- Definitions of cubic splines, spline representation, Hermite curve, Bezier curve and B-spline curve.

Surface Modelling: Surface modelling and entities, Algebraic and geometric form, Parametric space of Surface, Blending functions, Surface of revolution.

UNIT IV (12)

Solid Modelling: Solid models, Solid entities, Solid representation, Sweep representation, Constructive solid geometry and Boundary representation, Solid modelling based applications.

Rapid Prototyping:- Rapid prototyping-overview, techniques- Stereolithography, selective laser sintering,3-D printing, Fused Deposition Modelling, Laminated object manufacturing.

UNIT V (12)

Geometric Transformations: Transformation Principles of 2D & 3D-Translation, scaling, rotation, reflection and shear transformation matrix representations and homogeneous co- ordinates, composite transformations, transformations between coordinates.

Windows and clipping : The viewing pipe-line, viewing coordinate for reference frame, window to view-port co-ordinate transformations, viewing function, Cohen-Sutherland line clipping, Sutherland- Hodgeman polygon clipping algorithm.

LEARNING RESOURCES

TEXT BOOKS:

1. CAD/CAM by Mikel P.Groover and Emory W.Zimmers, Prentice Hall of India, Delhi.
2. CAD/CAM by P.N.Rao, Tata McGrawhill, Delhi.
3. CAD/CAM by Ibrahim Zeid,Tata McGrawill,Delhi.
4. Principles of Interactive Computer Graphics by Newman and Sproull,McGrawhill.
5. Principles of Interactive Computer Graphics, Neuman and Sproul, TMH.
6. Computer Graphics, Steven Harrington, TMH.

WEB REFERENCES:-

- http://www.sciencedirect.com/science/book/9780444511041
- http://nptel.ac.in/courses/112102101/

ME 409C	ELECTIVE V COMPUTATIONAL FLUID FLOW AND HEAT TRANSFER	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To understand the mechanism of computational fluid dynamics and significance of computational fluid dynamics in engineering application, such as turbine engineering and nuclear engineering.
2. To understand the discretization approach of computational fluid dynamics and its influence on the computation result.
3. To understand the numerical algorithm of computational fluid dynamics and its influence on the convergence of the computation.
4. For preliminarily understanding the mechanism of turbulence modelling.
5. To cultivate students capability, to apply or develop the computational method to solve the fluid flow and heat transfer problems.

COURSE OUTCOMES:

a. The course provides an introduction to computational fluid dynamics. The students will train the numerical solution of model problems.
b. After completion of this course, the student will have knowledge on Classification of the basic equations of fluid dynamics.
c. The student will be able to check and assess the accuracy of numerical results. Assessing the efficiency of numerical methods, consistency analysis choosing appropriate boundary conditions for model problems.
d. After completion of this course, the student will have awareness on the mechanism of turbulence modelling.
e. The student will be able to check and assess basic numerical methods for fluid flow problems and heat transfer problems.

UNIT I **(12)**

Introduction: CFD as a design tool, as a research tool, impact of CFD, Applications.
Governing Equations: Continuity, Momentum and Energy equations in3 Dimensions, Navier-Stokes equations, Single Generic Integral form equations for Continuity, Momentum and Energy.

UNIT II **(12)**

SECOND ORDER PDE'S: Classification of second order partial differential equations, Initial and boundary conditions, governing equations in generalized coordinates.
FINITE DIFFERENCE, DISCRETIZATION, CONSISTENCY, STABILITY AND FUNDAMENTAL OF FLUID FLOW MODELING: Introduction, Elementary finite difference quotients, Basic aspects of finite difference equations, Errors and stability analysis.

UNIT III **(12)**

FINITE DIFFERENCE, DISCRETIZATION, CONSISTENCY, STABILITY AND FUNDAMENTAL OF FLUID FLOW MODELING: Some nontrivial problems with discretised equations, Applications to heat conduction and convection.
SOLUTIONS OF VISCOUS INCOMPRESSIBLE FLOWS BY STREAM FUNCTION, VORTICITY FORMULATION: Two dimensional incompressible viscous flows, Incorporation of upwind scheme, Estimation of discretization error, Application to curvilinear geometries, Derivation of surface pressure and drag.

UNIT IV **(12)**
SOLUTION OF NAVIER-STOKES EQUATIONS FOR INCOMPRESSIBLE FLOWS USING MAC METHOD: Introduction, Staggered grid, Solution of the unsteady Navier -Stokes equations.
SOLUTION OF NAVIER-STOKES EQUATIONS FOR INCOMPRESSIBLE FLOWS USING SIMPLE ALGORITHM: Solutions of energy equation, Formulation of the flow problems, Simple algorithm.

UNIT V **(12)**
INTRODUCTION TO FINITE VOLUME METHOD: Integral approach, discretisation & higher order schemes, Application to complex geometry.
INTRODUCTION TO FINITE ELEMENT METHOD: Stiffness matrix, Isoparametric elements, Formulation of finite elements for flow and heat transfer problems.

LEARNING RESOURCES

TEXTBOOKS:
1. Muralidhar K. and Sunderrarajan T., "Computational Fluid Flow and Heat Transfer ", Narosa Publishing House, New Delhi, 2005.
2. Anderson D.A., Tannehill J.C. and Pletcher R.H., "Computational Fluid Mechanics and Heat Transfer",Hemisphere Publishing Co., New York, 2004.
3. Patankar S.V., "Numerical Heat Transfer and Flow" , McGraw Hill, New York, 2002.

REFERENCE BOOKS:
1. Ferziger J. H. and Peric M., "Computational Methods in Fluid Dynamics", Springer, New York, 2003.
2. Chung T. J., "Computational Fluid Dynamics", Cambridge University Press, London, 2005.

WEB RESOURCES:
- *www.cfd-online.com*
- *Fluent Inc. Product Documentation*
- *http://courses.cit.cornell.edu/fluent/index.htm*
- *http://www.flow3d.com/index.html*

ME 409D	ELECTIVE V TOTAL QUALITY MANAGEMENT	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Understand the philosophy and core values of Total Quality Management (TQM)
2. To give the students an overview of quality and TQM and explaining the salient contributions of Quality Gurus like Deming, Juran and Crosby. General barriers in implementing TQM.
3. To make students to understand the TQM concepts like customer focus, Employee Focus and their involvement, continous process improvement and Supplier Management.
4. Measure the cost of poor quality and process effectiveness and efficiency to track performance quality and to identify areas for improvement;
5. Explain the concepts of bench marking and new management tools of quality.
6. Apply and evaluate best practices for the attainment of total quality and cost of quality
7. To explore industrial applications of Quality function deployment, taguchi quality concepts and TPM.
8. To impart detailed exposure to students on various quality systems like ISO and its standards.
9. Know the history, the evolution and need for ISO 9000 quality systems

COURSE OUTCOMES:

a. Students will be able to gain basic knowledge in total quality management relevant to both manufacturing and service industry including IT sector.
b. Select and apply appropriate techniques in identifying customer needs, as well as the quality impact that will be used as inputs in TQM methodologies;
c. Students will be able to implement the basic principles of TQM in manufacturing and service based organization.
d. Measure the cost of poor quality and process effectiveness and efficiency to track performance quality and to identify areas for improvement;
e. Understand proven methodologies to enhance management processes, such as benchmarking and six-sigma;
f. The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.
g. The students will be able to gain the knowledge on various ISO standards and quality systems.

UNIT I **(12)**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality.

Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II **(12)**

TQM PRINCIPLES- Leadership – Strategic quality planning, Quality statements - Customer focus –Customer orientation, Customer satisfaction, Customer complaints, Customer retention -Employee involvement– Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal.

Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III **(12)**

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT.

Bench marking– Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV **(12)**

Quality circles – Quality Function Deployment (QFD) – the voice of the customer, house of quality, QFD process.

TPM Concepts, improvement needs – Cost of Quality – Taguchi quality loss function - Performance measures.

UNIT V **(12)**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits Case studies of TQM, Implementation in manufacturing and service sectors including IT.

TEXT BOOK:

1. Dale H.Besterfiled, at., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCE BOOKS:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. L
5. Girish Pathak ,"Total Quality Management- Macmillan publishers India Ltd.

WEB REFERENCES:-

- http://www.slideshare.net/mtaram/total-quality-management-presentation-949360
- http://www.slideshare.net/SunilKumar148/7total-quality-management-tqm
- http://www.slideshare.net/RRSrivastava/tqm-13501551

ME 410A	ELECTIVE VI ROBOTIC ENGINEERING	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To provide an introduction to Robotics and Automation including robot classification, design and selection, analysis and applications in industry.
2. To provide information on various types of end effectors, their design, interfacing and selection.
3. To provide the details of operations for a variety of sensory devices that are used on robot , the meaning of sensing, classification of sensor, that measure position, velocity & acceleration of robot joint.
4. The goal of the course is to familiarize the students with the basic concepts of transformations performed by robot.
5. Familiarize students to perform kinematics, to identify various joint movements and calculate the positions.

COURSE OUTCOMES:

a. At the end of the course, students will be familiarized in basic components of robotics, classification of robots and their applications.
b. They will have knowledge on types of robot grippers, their usage and design considerations.
c. They attain knowledge on various types of sensory devices their working and applications.
d. Students will apply basic transformations related to the movement of manipulator.
e. An ability to design a robot mechanism to meet kinematics requirements.

UNIT I **(12)**

Basics of Robot: Introduction to Robotics, major component of a robot, robotic like devices, classification of robots - Classification by coordinate system and by control method, Specifications of robots, fixed versus flexible automation.

Applications of robot: Economic analysis, Robot applications in Material Handling, Processing and assembly

UNIT II **(12)**

Robot End Effectors: Introduction, end effectors, interfacing, types of end effectors, grippers and tools.

Selection: Selection and Design Considerations of End effectors, Remote Centre Compliance device.

UNIT III **(12)**

Robotic Sensory Devices:

Position Sensors: Objective, Non-optical position sensors - potentiometers, synchros, inductocyn, optical position sensors – opto interrupters, optical encoders (absolute & incremental).

Proximity Sensors: Contact type, non-contact type – inductive, capacitive proximity sensors, optical proximity sensor, and scanning laser proximity sensor.

UNIT IV (12)

Touch and Slip Sensors: Proximity rod & photo detector tactile sensor, slip sensors - Forced oscillation slip sensor, interrupted type slip sensors.

Transformations: Objectives, homogenous coordinates, basic transformation operations, fixed angle representation, Euler angle representation.

UNIT V (12)

Forward Kinematics: Forward solution – Denavit Hartenberg procedure. Simple problems involving 2 and 3 DOF manipulators, SCARA manipulator.

Inverse Kinematics: Inverse or backward solution - Closed form solution, problems involved 2 and 3 DOF manipulators, SCARA manipulator.

LEARNING RESOURCES

TEXT BOOKS:

1. Robotic Engineering by Richard D.Klafter, Prentice-Hall of India Pvt Ltd, 2010.
2. Industrial Robotics by Mikell P. Groover, Tata McGraw-Hill Int. Edition 2, 2012.
3. Robotics and Control, R.K. Mittal and I.J. Nagarath, TMH, 2005.

REFERENCE BOOKS:

1. Introduction To Robotics: Mechanics And Control, John J. Craig 3rd edition, Pearson, 2008
2. Robotics: Control, Sensing, Vision, and Intelligence, K. S. Fu, R. C. Gonzales, and C. S. G. Lee, Tata McGraw-Hill, NY, 2008.
3. Introduction to Robotics: Analysis, Systems, Applications, Saeed B. Niku,Prentice Hall, NJ, 2010.

WEB REFERENCES:

- http://nptel.iitm.ac.in/courses.php?branch=Mechanical
- http://academicearth.org/courses/introduction-to-roboticsVideo references:-

ME 410B	Elective VI ADVANCED CONCEPTS IN MECHANICAL ENGINEEIRNG	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To introduce the neural networks as means for computational learning and demonstrate neural network applications on real-world tasks.
2. To familiarize with various types of neural networks their properties.
3. To identify the difference in condition monitoring and NDT tests and its diagnosis.
4. Familiarize with different phases of value engineering.
5. To gain knowledge on concepts of concurrent Engineering and its usage.

COURSE OUTCOMES:

a. The student will be able to obtain thefundamentals and types of neural networks.
b. Have an understanding of the concepts and techniques of neuralnetworks through the study of the most important neural networkmodels.
c. Able to perform condition based monitoring on different real systems.
d. Able to identify different phases to achieve les cost without compromising quality of products.
e. To identify various sources and schemes of concurrent engineering and to apply them in present scenario.

UNIT I **(12)**

Neural Networks: Introduction, Knowledge - based information processing, a general view of knowledge based algorithm.
Neural information processing, hybrid intelligence, artificial neuron.

UNIT II **(12)**

Basic Neural Computation Models: Basic concepts of Neural network - Network properties, node properties, sigmoid functions and System dynamics.
Inference and learning algorithm, Data representation, Functional classification models - single layer perceptions and multilayer perceptions.

UNIT III **(12)**

Condition monitoring: Introduction to condition monitoring ,Maintenance philosophies: time based versus condition based Intelligent fault detection, Nondestructive testing vs condition monitoring , Condition monitoring procedure and system integration.
Condition monitoring in real systems: Diagnostic tools, Condition monitoring of two stage compressor, Cement Mill Foundation, I.D. Fan, Sugar centrifugal, cooling tower fan.

UNIT IV **(12)**

Value Engineering: Introduction, phases invalue Engineering, Orientation phase, information phase, function phase.
Creation phase, evaluation phase, recommendation phase, implementation phase, audit phase.

UNIT V (12)

Concurrent Engineering: Key definitions, driving force behind, concurrent engineering, the meaning of concurrent engineering, schemes for concurrent engineering.
Axiomatic design, DFM guide lines, design for assembly, The Taguchi method for robust design, manufacturing process design rules, computer aided DFM.

LEARNING RESOURCES

TEXT BOOKS

1. Artificial Neural Networks by Yegnanarayana, PHI.
2. Limin Fu, Neural Networks in Computer Intelligence, Mc-Graw Hill, 1995.
3. Engineering Condition Monitoring" by R. Barron, Longman, 1996.
4. Condition Monitoring of Mechanical Systems by Kolacat.
5. Bart Kosho, Neural Networks and Fuzzy Systems, Prentice Hall of India, 1994.
6. Getting more at less cost;the value engineering way by G Jagannatham
7. Computer integrated design and manufacturing by David D Bedworth,McGraw-Hill, 1991.
8. Neural Networks, Fuzzy Logic and Genetic Algorithms: Theory andApplications, PHI Learning Pvt.Ltd.

WEB RESOURCES:

- www.productivity.in/.../Value%20Analysis/g....
- www.cs.berkeley.edu/.../Fuzzy%20Logic,%20Neural%20Netw...
- www.freequality.org/.../concurrentengineering%5B1%5D.ppt
- www.seattlerobotics.org/encoder/mar98/fuz/flindex.html

ME 410C	Elective VI SOLAR RADIATION AND ENERGY CONVERSATION	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. To know the present scenario of energy availability and requirement.
2. To acquaint with terminology of Solar radiation energy and equipment required for collecting solar energy.
3. To design different systems for collecting solar radiation.
4. To get the knowledge about solar thermal power plants.
5. To get the knowledge of Solar energy conversions.

COURSE OUTCOMES:

a. To get the knowledge of resources available for different energies.
b. The students will get the knowledge about the principle of Solar radiation and its utilization
c. The students will get the knowledge about Different solar collectors.
d. The students will get the knowledge about solar thermal power plants.
e. The students will get the knowledge solar energy conversions

UNIT I **(12)**

World energy resources: Indian energy scenario - Environmental aspects of energy utilization. Renewable energy resources and their importance - Global solar resources
Solar spectrum – Electromagnetic spectrum, basic laws of radiation. Physics of the Sun - Energy balance of the Earth, energy flux, solar constant for Earth, greenhouse effect.

UNIT II **(12)**

Solar radiation: Solar radiation on the earth surface - Extraterrestrial radiation characteristics, Terrestrial radiation, solar isolation, spectral energy distribution of solar radiation. Depletion of solar radiation – Absorption, scattering. Beam radiation, diffuse and Global radiation.
Measurement: Measurement of solar radiation Pyranometer, pyrheliometer, Sunshine recorder. Solar time - Local apparent time (LAT), equation of time (E).

UNIT III **(12)**

Solar radiation geometry:Solar radiation geometry - Earth-Sun angles – Solar angles. Calculation of angle of incidence - Surface facing due south, horizontal, inclined surface and vertical surface. Solar day length – Sun path diagram – Shadow determination.
Solar Radiation Calculations: Estimation of Sunshine hours at different places in India. Calculation of total solar radiation on horizontal and tilted surfaces.

UNIT IV **(12)**

Solar Collectors: Flat plate, Performance analysis of flat plate collector, Solar concentrating collectors, Types of concentrating collectors, Thermodynamic limits to concentration, Cylindrical collectors, Thermal analysis of solar collectors.
Solar Thermal Power Plants: Solar thermal energy storage, Different systems , solar pond, solar pond based electric power plant, central tower receiver power plant.

UNIT V (12)

Solar Electrical Energy Conversion: Solar photovoltaic system: Photovoltaic effect, Principle and operation of solar cells. Semiconductor materials for solar cells, Classification of solar PV systems.
Solar Electrical Energy Conversion: Solar cell energy conversion efficiency, I-V characteristics, effect of variation of solar insolation and temperature, losses. Solar PV power plants.

LEARNING RESOURCES

TEXT BOOKS:

1. Solar Energy: Fundamentals and Applications Garg & Prakash, H. P. Garg
2. Solar Photovoltaics: Fundamentals, Technologies And Applications Kindle Edition by CHETAN SINGH SOLANKI
3. Solar Energy: Principles of Thermal Collection and Storage By Sukhatme
4. An Introduction To Solar Radiation By Muhammad Iqbal

REFERENCE BOOKS:

1. Non Conventional energy resources - G.D. Roy
2. Solar Energy Conversion: The Solar Cell By R.C Nevil

WEB REFERENCES:

- http://nptel.iitm.ac.in/courses.php?branch=Mechanical
- http://www.slideshare.net/ms_optimisstic/solar-energy-7541878

ME 410D	Elective VI INDUSTRIAL ADMINISTRATION	L	T	P	M	C
		4	-	-	100	3

COURSE OBJECTIVES:

1. Understand the importance of engineering economics.
2. To provide the information regarding the types of business organisations.
3. To make students to understand the concepts and importance capital budgeting.
4. To know the calculation of manufacturing cost of a product.
5. To know the depreciation and methods of measuring depreciation.
6. Explain the economic evaluation of alternatives.
7. Provide an understanding of personnel management

COURSE OUTCOMES:

a. Able to understand concepts of economic environment.
b. Acquire knowledge of business organizations while establishing the industry.
c. Appreciate the importance of depreciation and value of money.
d. Know the importance of capital and its effective utilization.
e. Develop the skills to estimate the product cost and fixing its selling price.
f. Describe the role and responsibilities of personnel management in organization
g. Differentiate the structures of various organization systems
h. Understand the concept of job design and analysis.

UNIT I **(12)**

THE ECONOMIC ENVIRONMENT: Consumer and producer goods and services, measure of economic worth, necessities, luxuries, and price-demand-supply functions.
FORMS OF BUSINESS ORGANIZATION: Sole proprietorship, partnership, Joint stock company-private limited company and public limited company, Public sector, Government owned company, co-operatives, Salient features, formation, advantages, disadvantages, comparison.

UNIT II **(12)**

FINANCIAL MANAGEMENT: Introduction, Balance sheet used and interpretation, financial ratio analysis, capital its necessity, Classification/determination of capital requirement, factors effecting capital, cost of capital.
COSTING AND ESTIMATING: Elements of cost, direct cost, indirect cost, fixed cost, variable cost, semi-variable cost, prime cost, manufacturing cost, overheads, allocation of overheads, determination of various costs, problems.
Objectives and functions of estimating the cost, cost estimating methods, engineering procedure, analogy and statistical methods, estimation of material cost, cost of machining operations such as tuning, drilling, boring, milling etc.

UNIT III **(12)**

INTEREST AND TIME VALUE OF MONEY: The return to capital origins of interest, simple interest, compound interest, equivalent cash flow diagrams, interest formulas-Discrete compounding, present and future worth of single amounts, uniform series to its present and future worth deferred annuities, uniform gradient series, nominal and effective interest rates.

DEPRECIATION: Definitions of value, value of rate setting, purposes/ Types of depreciation, common methods of depreciation, The straight line method, Declining balance method, The sum of the years digits method, the sinking fund method, the service output method, depletion.

UNIT IV **(12)**

CAPITAL BUDGETING & ECONOMIC EVALUATION OF ALTERNATIVES: Need, importance, criteria and methods of Budgeting, Basic methods-the annual worth method, present worth method, future worth method, internal rate of return method, selections among alternatives. A basic philosophy for studies of alternatives, alternatives having identical revenues and lives, alternatives having different lives, alternatives having different revenues, alternatives involving increasing future demands.

COMPENSATION ADMINISTRATION: Principal compensation issues, wage criteria-prevailing wages, ability to pay, cost of living, bargaining power, wage policy and principles, job evaluation system –ranking system, Grade-Description system, point system, Factor comparison system, establishing the pay structure compensation for professionals, compensation for managers.

UNIT V **(12)**

PERSONNEL MANAGEMENT: The personnel function, staff role of the personnel department, personnel functions, Unions and management, collective bargaining, grievances and arbitration.

JOB DESIGN AND ANALYSIS: Job design, job information and personnel management, analyzing jobs-obtaining job information, Functional job analysis, human resource of organisation, implementation programs: Brief treatment of recruitment, selection, placement, performance appraisal, career development, promotion, transfer, retirement, Training and development, motivation and compensation.

TEXT BOOKS:

1. Engineering Economy- K.Paul Degarmo, Jhon R. Canda, William G. Sullivan

REFERENCE BOOKS:

1. Principles of Engineering Economy by Crant, Ireson, Leavenworth.
2. Engineering Economy by Thueson, Fabryesky, Tueson
3. Engineering Economics and Management by G.K Mithal, R.Mithal
4. Personnel- The Managements of people at work by Dale S. Beach

WEB REFERENCES:

- http://www.slideshare.net/searchanandu/industrial-management-unit-2
- http://www.slideshare.net/aadityanagpal/forms-of-business-organisations-27056960
- http://www.slideshare.net/RahulKaurav/unit-2-p2-29092488

ME 454	CAM LAB	L	T	P	M	C
		-	-	3	100	2

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 Mastercam 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:

a. The students are able to write a CNC program for the profile to be generated. This is done with the help of CAM software.
b. The students are able to know and perform various operations on CNC Lathe and milling machines effectively and safely.
c. The students are able to create models for different contours and will be in a position to convert the part geometry into a NC code which is used for machining on CNC Lathe and milling machines

Any Ten Experiments should be performed:

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 455	PROJECT WORK	L	T	P	M	C
		-	-	9	100	10

COURSE OBJECTIVES:

1. To prepare the graduate to analyze a problem, identify and define the computing and hard ware requirements appropriate to its solutions.
2. To strengthen the knowledge of design and development principles in executing the projects.
3. To provide the knowledge for preparing rich documentation.
4. To impart the knowledge and skills to do advanced studies and research in Mechanical Engineering discipline.
5. To equip the student with both oral and written communication skills to become an effective team oriented problem solver as well as an effective communicator with technical and non-technical stakeholders..

COURSE OUTCOMES:

a. The graduate will able to identify and analyze a problem. The graduate will be able to function effectively on teams to accomplish a common goal.
b. The graduate will be able to use current techniques, skill and tools necessary for completing an assignment.
c. The graduate will be able to design and develop applications in the related areas of Mechanical Engineering.

The Project Report has to be submitted at the end of the semester and marks will be awarded based on the Viva-voce examination.

Methodology for Project work

- The students are divided into batches and each batch will be allotted one guide.
- Each batch consists of maximum of 6 students.
- The students are allowed to take up the problems related to core domains of curriculum such production engineering, design, thermal engineering, industrial engineering and management.
- The students are permitted to do project work on industry related problems also.
- The sessional marks shall be awarded based on the weekly progress, the performance in two Seminars and the Project Report submitted at the end of the semester.