REGULATIONS, COURSE STRUCTURE AND SYLLABUS

(Aligned with AICTE Model Curriculum 2018-19)

2018 Regulations

For

B.Tech. First Year Programs

With effective from the Academic Year 2018-19

Our Management…

VISION

Confect as a premier institute for professional education by creating technocrats who can address the society`s needs through inventions and innovations.

MISSION

- Partake in the national growth of technological, industrial arena with societal responsibilities
- Provide an environment that promotes productive research
- Meet stakeholder’s expectations through continued and sustained quality improvements

QUALITY POLICY

Sasi Institute of Technology and Engineering is committed to achieve global standards and excellence in teaching, research and consultancy by creating conducive environment in the fields of technological, managerial studies with professionalism and global outlook ensuring continuous improvement.

From Chairman's Desk…

I am greatly honored to serve the society as President of Sasi Institute of Technology & Engineering at Tadepalligudem.

At Sasi, students are trained to become not only efficient Engineers but also good people who render great service to the humanity in all aspects. As production, software and service industries are shifting to India, our country needs lakhs of Engineers to fulfill the demand. These Engineers need to be creative in thinking, innovative in execution, proficient in oral and written communication, able to work for longer hours effectively in teams, on multi - disciplinary projects. In fact, these are our core teaching values at our Sasi Institute of Technology & Engineering.

Chairman's Profile

Shri Burugupalli Venu Gopala Krishna, the President, Sasi Educational Society is a well known personality in the field of education for the last 35 years in coastal districts of Andhra Pradesh. He believes in hard work and always says Success is measured not by what you create for yourself but by what you leave behind.

As a man of integrity and honesty, he sets an example for all and loves to stay with the students in the campus,

motivating and moulding them into ideal students. In the highly competitive field of education, it may be a glorious dream for many an educationist to see his school as the best and get an award at least once in life. But Mr. B. Venu Gopala Krishna has outsmarted everyone by winning the state best school award four times consecutively. It is testimony for his lifelong devotion for the cause of education.

Mr. B. Venu Gopala Krishna, the son of a small farmer, is now a lord of an educational empire which has more than 15, 000 students. One can understand well, the meaning of commitment and dedication when one walks through the corridors of the schools and the colleges. By starting his school in the small village of Velivennu, he has proved it loud and clear that wherever you work with commitment and dedication, you will make a mark and attract the attention of millions.

The schools he started get the best school awards consecutively, the junior colleges he established produce many national and state level ranks year after year, but his thirst for service in the field of education still remains unquenchable and insatiable. It is no exaggeration to say that he stands as a role model for many young enthusiastic educationists. With his leadership, Sasi English Medium School has bagged state best school award five times in a

row!. He received TVN - KIDAO - Outstanding Education Institution- 2014 award for Sasi Institute of Technology & Engineering from National Institution for Quality and Reliability, Chennai.

He is actively involved in social service and generous in donating a lot to CMs Relief Fund, Cargil Relief Fund, Helpage India and other social service organizations. He is keen in rural development and thus in the process he established most of the educational institutions in rural areas.

From Vice Chairman's Desk…

I take great pride in welcoming you to our campus. We assure a climate that encourages learning and personal growth. We value commitment to excellence in all we do.

The aim of institution is to teach how to think, than what to think and how to learn than what to study. Education is the very way of our life and when it improves, life does too. Our motto is to provide a quality education to rural people which we are doing since 1980.

Sasi Educational Institutes is recognized institution offering excellent school, college undergraduate, graduate & professional education through 12 schools and colleges to nearly 10, 000 students. Sasians work every day to advance the common good in uncommon ways. We teach, we explore and We discover. We collaborate and lead. We innovate, inspire, and empower. We achieve our potential and create circumstances that help our students and others achieve theirs.

Our Founder's words are inspiration to us " No riches buy knowledge: but, knowledge owns any riches in the world." I know SASI is still learning to leap. It has many heights to climb up. It has long distances to walk, But I assure

you, with the co-operation and faith of that you have laid on us, that we would work for your best satisfaction during the times coming a head.

From Secretary & Correspondent's Desk…

SITE is a proud mission driven community providing a world class education, celebrating the fact that each student is different, as a person and as a learner.

We believe that powerful learning and teaching occurs under a shared spirit of respect which creates a passionate schooling experience recognized for its warmth, energy and excellence.

"I cannot teach anybody anything, I can only make them think"-Socrates. Open mindedness, a multicultural orientation, independence, a global outlook, multiple intelligences and abilities – these are the premium qualities needed today. As a 21st century organization, the institution desires to set an approach to learning that incorporates inquiry, research, analytical thinking and an ethical approach that becomes a lifetime habit. The students are helped to focus on confidence building, while nurturing a strong sense of social and environmental responsibility through academic and co-curricular activities as we believe, like Paul "Bear" Bryant

that, “It is not the will to win, but the will to prepare to win that makes the difference”.

I strongly believe that education is a collaborative effort that involves professional administrators, committed teachers and motivated students. We dedicate ourselves as professional administrators in creating a dynamic education programme empowering the students in a global perspective.

From Principal's Desk…

Teaching & learning process is effective, unparallel and effectively implemented by the dynamic Head of the Departments with the support of the respective faculty members.

Special programs like seminars on improving learning capabilities, continuous training to face the market challenges, industrial visits, arranging guest faculty, seminars to improve the communication, technical skills and guidance for placements, GRE, TOEFL, examinations.

We provides amenities like training for placement, internet(24x7), hostel for boys and girls, medical facility, additional training to the hostel students, transport from every corner of the district, canteen and parent interaction cell for continuous information and guidance.

Principal's Profile

Dr. K.Bhanu Prasad, M.E., Ph.D., The Principal of Sasi Institute of Technology & Engineering, is an eminent achiever in his vast service of 34 years. He is a pathfinder for both the students and for the development of the Institution. He completed his Doctorate in Electronics Engineering - Sri Krishnadevaraya University, Anantapur, Andhra Pradesh. His

Professional Membership in Scientific and Professional Societies are as follows:-

- Fellow - Associate Member of The Institution of Engineers
- Fellow - Institution of Electronics and Telecommunication Engineers
- Senior Member - MICCPI

He has flourished around 14 National & International journal publications and presented in 18 conferences.

Chapter-I

UG Regulations

Chapter – I

B.Tech. Regulations

1.1. Short Title and Commencement

The regulations listed under this head are common for all degree level under graduate programs (B.Tech.) offered by the college with effect from the academic year 2018-19 and they are called as "SITE18" regulations.

The regulations here under are subject to amendments as may be made by the Academic Council of the college from time to time, keeping the recommendations of the Board of Studies in view. Any or all such amendments will be effective from such date and to such batches of candidates including those already undergoing the program, as may be decided by the Academic Council.

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1.2. Definitions

a. "Commission" means University Grants Commission (UGC)

b. "Council" means All India Council for Technical Education (AICTE)

c. "University" Means Jawaharlal Nehru Technological

University Kakinada (JNTUK)

d. "College" means Sasi Institute of Technology & Engineering, Tadepalligudem.

e. "Program" Means any combination of courses and /or requirements leading to award of a degree

f. "Course" Means a subject either theory or practical identified by its course title and code number and which is normally studied in a semester.

g. For example, (Data Structures) is a course offered at third semester of B.Tech (CSE) and its code is (18CSCST3020)

h. "Degree" means an academic degree conferred by the university upon those who complete the undergraduate curriculum

i. "Regular Student" means student enrolled into the four year programme in the first year

j. "Lateral entry Students" Means student enrolled into the four year programme in the second year

1.3. Academic Programs

1.3.1. Nomenclature of Programs

The nomenclature and its abbreviation given below shall continue to be used for the degree programs

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under the University, as required by the Council and Commission. The name of specialization shall be indicated in brackets after the abbreviation. For e.g. UG engineering degree in Mechanical Engineering program is abbreviated as B.Tech. (ME). Bachelor of Technology (B.Tech.) degree program offered in:

1. Civil Engineering (CE)
2. Computer Science and Engineering (CSE)
3. Electronics and Communication Engineering (ECE)
4. Electrical and Electronics Engineering (EEE)
5. Information Technology (IT)
6. Mechanical Engineering (ME)

1.3.2. Duration of the Programs

- **Normal Duration**
  - The duration of program for regular students shall be four years consisting of eight semesters
  - The duration of the program for lateral entry students who are admitted in second year shall be three years consisting of six semesters.
- **Maximum Duration**
  - The maximum period which a student can take to complete a full time program shall be double the

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normal duration of the program, i.e., for regular students eight years.

- For lateral entry students the maximum duration is six years.

- **Minimum Duration of a Semester**
  - Each semester consists of a minimum of 90 instruction days with about minimum 25 and maximum 35 contact periods per week

1.4. Admission Criteria

The eligibility criteria for admission into UG engineering programs are as per the norms approved by government of Andhra Pradesh from time to time. The sanctioned seats in each program in the college are classified into CATEGORY-A and CATEGORY-B at first year level and Lateral Entry at second year level.

- **CATEGORY – A Seats:** These seats will be filled as per the norms approved by the Government of Andhra Pradesh.
- **CATEGORY – B Seats:** These seats will be filled by the College as per the norms approved by the Government of Andhra Pradesh.
- **CATEGORY – Lateral Entry Seats**: Lateral entry

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candidates shall be admitted into the Third semester directly as per the norms approved by government of Andhra Pradesh. The percentages of Category-A, Category-B and Lateral Entry Seats are decided time to time by the Government of Andhra Pradesh.

1.5. Credit System

Credit means quantifying and recognizing learning. Credit is measured in terms of contact hours per week in a semester.

1.5.1. Credit Structure

A typical Credit Structure for course work (B.Tech Program) based on the above definition is given in the Table 1.

Table 1: Typical Credit Allocation Scheme for Course

Lectures (L)	Tutorials (T)	Practical (P)	Total Periods	Total Credits
3	1	0	4	3
0	0	3	3	1.5

1.5.2. Semester Course Load

The average course load shall be fixed at 20 credits per semester with its minimum and maximum limits being set at 17.5 and 23 credits, respectively.

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1.5.3.Grade Points and Letter Grade for a Course

The grade points and letter grade will be awarded to student in each course based on his/her performance as per the grading system shown in the Table 2.

Table 2: Grade points and letter grade scheme for a course

Theory	Lab/Project	Grade Points	Letter Grade
85-100%	85-100%	10	Ex
75-84%	75-84%	9	A+
70-74%	70-74%	8	A
65-69%	65-69%	7	B+
60-64%	60-64%	6	B
50-59%	55-59%	5	C
40-49%	50-54%	4	D
< 40%	< 50%	0	F (Fail)

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1.5.4.Semester Grade Points Average (SGPA)

The performance of each student at the end of the each semester is indicated in terms of SGPA. The SGPA is calculated as shown in eq.1

$$\text{SGPA} = \frac{CR * GP}{\text{CR (for all courses offered in semester)}} \quad \text{--- (1)}$$

Where CR = Credits of a course

GP = Grade points awarded for a course

SGPA is calculated for the candidates who passed all the courses in that semester.

1.5.5.Cumulative Grade Point Average (CGPA)

The Cumulative Grade Point Average is a calculation of the average of all courses required for obtaining the degree. The CGPA is calculated as shown in eq.2

$$\text{CGPA} = \frac{CR * GP}{\text{CR (for all courses offered in semester)}} \quad \text{--- (2)}$$

Where CR = Credits of a course

GP = Grade points awarded for a course

1.6. Curriculum Framework

1.6.1. General Issues

- Curriculum framework is important in setting the right direction for a Degree program as it takes into account the type and quantum of knowledge necessary to be acquired by a student to qualify for a award in his/her chosen branch or specialization.
- Besides, this also helps in assigning the credits for each course, sequencing the courses semester-wise and finally arriving at the total number of courses to

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be studied and the total number of credits to be earned by a student to fullfil the requirements for conferment of degree.

- Each theory course shall consist of five units.

1.6.2. Curriculum Structure

The curriculum structure is designed in such a way that it facilitates the courses required to attain the expected knowledge, skills and attitude by the time of their graduation as per the needs of the stakeholders. The curriculum structure consists of various course categories (as described in 1.6.3 to 1.6.9) to cover the depth and breadth required for the program and for the attainment of program outcomes of the corresponding program. Each Programme of study will be designed to have 40-45 theory courses and 16-18 laboratory courses. The distribution and types of courses offered from the above is indicated in the following table 3.

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1.6.3. Induction Program

The Induction Program for two weeks is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build

Table 3: Comparison of Number of credits given by AICTE and Approved credits

S. No.	Category	No. of Credits									
		ECE		EEE		CSE/IT		ME		CE	
		AICTE	Approved	AICTE	Approved	AICTE	Approved	AICTE	Approved	AICTE	Approved
1	Humanities and Social Sciences	12	11	12	11	12	11	12	11	12	08
2	Basic Science courses	25	23	26	25	24	26	25	26	26	26
3	Engineering Science courses	24	23	20	20	29	29.5	24	23	29	24.5
4	Professional Core courses	48	56	53	62	49	48.5	48	55	47	56.5
5	Professional Elective Courses	18	20	18	15	18	18	18	18	23	21
6	Open elective courses	18	12	18	12	12	12	18	12	11	9
7	Project work , Seminar and Internship	15	15	11	15	15	15	15	15	12	15
8	Mandatory Courses	-	-	-	-	-	-	-	-	-	-
Total Credits		**160**	**160**	**158**	**160**	**159**	**160**	**160**	**160**	**160**	**160**

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relations between teachers and students and building of character. The Universal Human Values component, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and nature, and character to follow through. It also makes them reflect on their relationship with their families and extended family in the college. It also connects students with each other and with teachers so that they can share any difficulty they might be facing and seek help. Induction Program covers

- Physical activity
- Creative arts
- Universal human values
- Literary and Proficiency modules
- Lectures by Eminent People
- Visits to local Areas & Familiarization to Dept./Branch & Innovations

1.6.4. Institutional Core

Institutional Core courses give the knowledge, skills and attitude expected in UG engineering graduates of all programs. The courses offered under this category are:

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1. **Humanities and Social Sciences**

   Humanities and Social Science Courses shall include Technical English, Constitution of India, Professional Ethics and Human Rights, Environmental Studies, Personality Development & Professional Communication, Management Science, Engineering Economics and Financial Management and English Language Communication Skills Lab.

2. **Basic Sciences**

   Science courses shall include Engineering Physics, Engineering Chemistry, Engineering Physics Lab, Engineering Chemistry Lab, Engineering Mathematics and Biology for engineers

3. **Engineering Sciences**

   Engineering Science courses shall include Programming for Problem Solving, Basic Electrical Engineering, Basic Electronics Engineering, Basic Electronics, Engineering Mechanics, Programming for Problem Solving Lab, Basic Electrical Engineering Lab, Engineering Drawing and Workshop / Manufacturing Practice

1.6.5. Program Core

The program core consists of set of courses

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considered necessary for the students of the specific program. The courses under this category should satisfy the programs specific criteria prescribed by the appropriate professional societies.

1.6.6. Program Electives

The program electives are set of courses offered in the program which covers depth and breadth to further strengthen their knowledge. The students may register for appropriate electives offered in the program based on their area of interest.

1.6.7. Open Electives

The students are expected to learn the course offered under this category under interdisciplinary.

1.6.8. Industry Interaction

- Internships/Mini Project
  - The students are expected to do internship of minimum 3 weeks duration in the industry approved by respective Head of the Department. It carries two credits.

1.6.9. Student Practice

Student Practice Courses are aimed at improving their professional competency. Student will have to participate successfully in the activities listed below.

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Student shall participate in any two events from (a) one and any one activity from [b – d], before completion of 6th semester

a) Co-curricular participation
   - Student should have participated in Technical Quizzes/Student paper contest/ Seminars/ Conferences etc., approved by the department.

b) National Service Scheme (NSS)/ National cadet Corps(NCC)/Yoga Practice
   - Student should have enrolled as a member of NSS at least for one year.

c) Games and Sports
   - Participation in the university level and above competitions.

d) Art and Cultural
   - Participation in the university level and above competitions.

1.7. Course Numbering Scheme

The Course number code consists of 11 alphabets. A typical course number code is illustrated in the following Figure-1.

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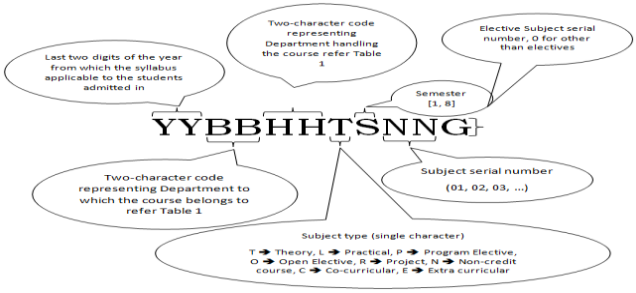

Figure 1: Course Numbering Scheme

The department codes are in given in following table 4.

Table 4: Department Codes

Department	Two-character code
Civil Engineering	CE
Electrical & Electronics Engineering	EE
Mechanical Engineering	ME
Electronics & Communications Engineering	EC
Computer Science Engineering	CS
Information Technology	IT
Management Science	MS
Mathematics	MA
Physics	PH
Chemistry	CH
English	EG
Biology	BI
Common to All Branches	CM

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Example: STLD in 3rd semester for ECE with S.No 2

Course Code: 18ECECT3020

1.8. Examinations and Scheme of Evaluation

- **Continuous Evaluation (CE),** to be conducted by the course faculty/course coordinator all through the semester, and, to include midterm test, assignments, seminar, project and other means covering the entire syllabus of the course.
- **Semester End Examination (SE)**, to be conducted by chief controller of examinations at the end of a semester, as per the academic calendar and to include a written examination for theory courses and practical/project examination with built-in oral part for laboratory/project courses.

1.9. Continuous Evaluation (CE)

1.9.1. Theory Courses

- **Internal Evaluation**
  - For each theory course there shall be continuous evaluation for 30 marks. Continuous evaluation for theory courses consists of three components, namely, home assignment, mid-term examination and Class test.
  - 5 marks in each theory course shall be allotted for home assignments and Class tests. The home assignments are to be decided by the course

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coordinators. There shall not be an overlap or repetition of questions/problems of home assignments with those of class tests. Separate problems are to be given for the home assignments for five marks to provide broadened exposure to the subject.

- Two midterm examinations each for 20 (15 marks for conventional paper and 5 marks for objective paper carrying 10 questions through online) will be conducted 90 minutes of theory and 20 minutes of online exam.
- The question paper shall be given in the following pattern.
  - For each midterm examination 50% syllabus should be completed. There shall be five questions considering two questions from each unit. Student should answer one question from each unit.
  - Average of two midterm exams + average of two home assignments + average of two class tests will be the final midterm examination marks.

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- **External Evaluation**
  - The Semester end examinations shall be conducted for 3 hours duration at the end of the semester for 70 marks. The question paper shall be given in the following pattern:
  - **Part-A:** Shall contain 10 questions of one mark each. A minimum of two Questions will be given from each unit of the syllabus out of five units.
  - **Part-B:** There shall be two questions from each unit with internal choice. Each question carries 12 marks. Each course shall consist of five units of syllabus.

1.9.2.Laboratory Courses

- **Internal Evaluation**
  - For Laboratory courses there shall be continuous evaluation during the semester for 50 marks and semester end examination for 50 marks. The distribution of continuous evaluation is given in the Table 5:

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Table 5: Continuous Evaluation for laboratory courses

S.No.	Criteria	Marks
1	Day to Day work	20
2	Record	10
3	Internal Examination	20
	Total	50

- **External Evaluation**
  - The semester end examination for laboratory courses shall be conducted for three hour duration at the end of semester for 50 marks. The distribution of marks shall be as shown in Table 6.
  - Each semester end lab examination shall be evaluated by an external examiner along with an internal examiner. The average of the marks awarded by internal and external examiners shall be taken into consideration.

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Table 6: Scheme of Evaluation of laboratory

S.No.	Criteria	Marks
1	Procedure / Algorithm & Program	15
2	Experiment/ Program Execution	15
3	Result Analysis	10
4	Viva-Voce	10
	Total	50

1.9.3. Term Paper and Mini Project

- **Internal Evaluation**

For Term Paper / Mini Project there shall be continuous evaluation during the semester for 50 marks and semester end evaluation for 50 marks. The distribution of continuous evaluation is given in the Table 7:

Table 7: Continuous Evaluation

S.No.	Criteria	Marks
1	Day to Day Assessment	20
2	Two Seminars	15+15
	Total	50

- **External Evaluation**

The distribution of Semester end examination marks for Term Paper and Mini Project is given in the Table 8. The semester end examination shall be evaluated by program coordinator and senior faculty nominated by the chief controller of examinations.

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Table 8: Semester end evaluation of Term Paper and Mini Project

S.No.	Criteria	Marks
1	Report	30
2	Seminar/Project Demonstration	20
	Total	50

1.9.4. Major Project Phase-I

- **Internal Evaluation**

  For major Project phase-I there shall be continuous evaluation during the semester for 100 marks. The student has to complete problem formation, literature survey and analysis and design of the project. The continuous evaluation for the Major Project shall be on the basis of two seminars by each student on the topic of his/her project. These seminars are evaluated by project review committee. In addition to this the project guide will evaluate for day to day performance. The project review committee shall consist of Head of Department, program coordinator and one senior faculty member of department. The distribution of marks is given in the Table 9:

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Table 9: Continuous Evaluation for major project Phase-I

S.No.	Criteria	Marks
1	Two Seminars	15+15
2	Day to Day Assessment	20
3	Project Review Committee	50
	Total	100

1.9.5.Major Project Phase-II

- **Internal Evaluation**

For major Project Phase -II there shall be continuous evaluation during the semester for 100 marks and semester end evaluation for 100 marks. The student has to complete software/Hardware implementation, Testing and calibration and final report. The continuous evaluation for the Major Project phase-II shall be on the basis of two seminars by each student on the topic of his/her project. These seminars are evaluated by project review committee. In addition to this the project guide will evaluate for day to day performance. The project review committee shall consist of Head of Department, program coordinator and one senior faculty member of

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department. The distribution of marks is given in the Table 10

Table 10: Continuous Evaluation for major project

S.No.	Criteria	Marks
1	Two Seminars	30+30
2	Day to Day Assessment	40
	Total	100

- **External Evaluation**
  - The Semester end examination for major project work shall be evaluated for 100 marks by a committee consisting of an external examiner, Head of the Department and project guide. The evaluation of project work shall be conducted at the end of the VIII Semester.
  - The average of the marks awarded by the committee members shall be taken into consideration in case of variation among the members.
  - The evaluation of 100 marks is distributed as given in Table 11:

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Table 11: Semester end evaluation of Major Project

S.No.	Criteria	Marks
1	Report	30
2	Presentation	35
3	Project Demonstration/Execution	35
	Total	100

1.9.6.Self-Learning Courses

If none of the program offering program elective or open elective or if few students opt an elective then that subject will be considered as self learning course with the prior approval of the Head of the department and principal.

The semester end examinations for courses under this category are evaluated for 70 marks. The question paper shall be set as described in theory courses by course coordinator and same is to be given to the controller of examinations. The evaluation of the semester end examination will be carried by the course coordinator.

1.9.7.Industry Interaction / Industry offered Courses / Internships

The candidate shall submit the comprehensive report to the department. The report will be evaluated

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for 100 marks by the project review committee.

1.10. Conditions for Pass

A candidate shall be declared to have passed in individual theory/drawing course if he/she secures a minimum of 40% aggregate marks (Continuous Evaluation and semester end examination marks put together), subject to a minimum of 35% marks in semester end examination.

A candidate shall be declared to have passed in individual lab/project course if he/she secures a minimum of 50% aggregate marks (Continuous Evaluation and semester end examination marks put together), subject to a minimum of 40% marks in semester end examination.

The student has to pass the failed course by appearing the supplementary examination as per the requirement for the award of degree. On passing a course of a program, the student shall earn assigned credits for that Course.

1.10.1 Withholding of Results

If the student has not paid any dues to the college or if any case of malpractice or indiscipline is pending against him, the result of the student will be

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withheld and he will not be allowed into the next semester. His/her degree will be withheld in such cases.

1.11.Criteria to Attend Semester End Examination and Promotion to Higher Semester

1.11.1 Eligibility for Semester End Examinations

- **Attendance**

  Regular course of study means a minimum average attendance of 75% in all the courses computed by totaling the number of periods of lectures, tutorials. Drawing, practical, Personality development courses and project work as the case may be, held in every course as the denominator and the total number of periods attended by the student in all the courses put together as the numerator.

  Condonation of shortage in attendance may be recommended by respective Heads of Departments on genuine medical grounds, provided the student puts in at least 65% attendance as calculated above and provided the Principal is satisfied with the genuineness of the reasons and the conduct of the student. Students, having more than 65% and less than 75% of attendance, shall

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have to pay requisite fee towards condonation.

1.11.2 Conditions for Promotion

A student shall be eligible for promotion to next Semester of B.Tech program, if he/she satisfies the conditions as stipulated in section 1.11.1

- Eligible candidate who failed to register for the semester-end examinations shall not be permitted to continue the subsequent semester, and has to repeat the semester for which he/she has not registered for semester end examinations.
- Student admitted to 5^{th} sem should clear all the 1^{st} sem subjects
- Student admitted to 6^{th} sem should clear all the 1^{st} & 2^{nd} sem subjects
- Student admitted to 7^{th} sem should clear all the 1^{st}, 2^{nd} & 3^{rd} sem subjects
- Student admitted to 8^{th} sem should clear all the 1^{st}, 2^{nd} , 3^{rd} & 4^{th} sem subjects

1.12. Eligibility for award of B.Tech. Degree

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

- **Regular Students**
  - A Regular student (4 year program) should

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register himself/herself for 160 Credits from the categories 1.6.4 to 1.6.8, and shall secure 160 credits.

- Student shall register for courses categories 1.6.9 and successfully complete as given in 1.9

- **Lateral Entry Students**
  - A lateral entry student (3 year program) should register himself for 122 credits from the categories 1.6.5 to 1.6.9 and shall secure 122 credits.
  - A lateral entry Student shall register for courses categories 1.6.9 and successfully complete as given in 1.9

- **Award of Division**

The criteria for award of division, after completion of program are as shown in Table 12.

Table 12: Criteria for award of division

S.No.	CGPA	Division
1	> = 7.75	First class With Distinction
2	> = 6.5 - <7.75	First Class
3	> = 5.5 - <6.5	Second Class
4	> = 4 -< 5.5.	Pass Class
5	< 4	Fail

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For the purpose of awarding First Class with Distinction CGPA obtained

- **Within 4 years –** in case of candidates admitted through EAMCET and Management Quota
- **Within 3 years** – in case of Lateral Entry candidates admitted through ECET
- Detained and break –in study candidates are not eligible for the award of First Class with Distinction.
- For the purpose of awarding First, Second and pass Class. CGPA obtained in the examinations appeared within the maximum period allowed for the completion of course shall be considered.

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1.12.1.Consolidated Grade Card

A consolidated grade card containing credits and grades obtained by the candidates and the average semester attendance will be issued after completion of the four year B.Tech Program.

1.12.2. Improvement of Cumulative Grade Point Average

A candidate, after becoming eligible for the

award of the Degree, may reappear for the semester end Examination in any of the theory courses as and when conducted, for the purpose of improving the aggregate and the class. But this reappearance shall be within a period of two academic years after becoming eligible for the award of the Degree.However, this facility shall not be availed of by a candidate who has taken the Provisional Certificate, Candidate shall be permitted to reappear for semester end examinations only for theory courses. Modified Grade Cards and New Consolidated Grade Card will be issued after incorporating new Grades and Credits.

1.13.Amendments to Regulations

The Academic Council may, from time to time, revise, amend or change the regulations, schemes of examination and/or syllabi.

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DISCIPLINARY ACTION FOR MALPRACTICES/IMPROPER CONDUCT IN EXAMS

S. No.	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
1. (b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered

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		against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year.The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated , shall be cancelled in all the subjects of the

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		examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the	Expulsion from the examination hall and cancellation of performance in that subject and all the

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	examination or answer book or additional sheet, during or after the examination.	other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief	In case of students of the college, they shall

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	Superintendent / Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of	be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

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	unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with

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		forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the

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		subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and

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		project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

MALPRACTICES

- The Principal shall refer the cases of malpractices in Continuous Evaluation and Semester-End Examinations, to 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 students based on the recommendations of the committee.
- Any action on the part of student at an examination trying to get undue advantage in the performance or trying to help another, or derive 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

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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 at the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

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COURSE STRUCTURE AND DETAILED SYLLABUS

for

B.Tech.

First Year All Programs

With Effective from the academic year

2018-2019

Program Outcomes for an Engineering Graduates:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
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.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent

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responsibilities relevant to the professional engineering practice.

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.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.
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.
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 change.

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I B. Tech I Semester Course structure for the Academic Year 2018-2019

Common for ECE/CSE/IT

S. No.	Subject Code	Subject title	L	T	P	C
1	18CMMAT1010	Engineering Mathematics-I	3	1	0	4
2	18ECPHT1020, 18CSPHT1020, 18ITPHT1020	Engineering Physics	3	1	0	4
3	18CMCST1030	Programming for problem solving	3	0	0	3
4	18CMMEL1040	Engineering Graphics	1	0	4	3
5	18ECPHL1050, 18CSPHL1050, 18ITPHL1050	Engineering Physics Lab	0	0	3	1.5
6	18CMCSL1060	Programming for problem solving lab	0	0	4	2
7	18CMMEL1070	Work Shop/Manufacturing practice	0	0	3	1.5
Total Credits						**19**
Environmental Science (Non -Credit course)						

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I B. Tech II Semester Course structure for the Academic Year 2018-2019

Common for ECE/CSE/IT

S.No.	Subject Code	Subject title	L	T	P	C
1	18CMEGT2010	Technical English	3	0	0	3
2	18CMMAT2020	Engineering Mathematics II	3	1	0	4
3	18CMCHT2030	Engineering Chemistry	3	1	0	4
4	18CMEET2040	Basic Electrical Engineering	3	1	0	4
5	18CMEGL2050	English Communication skills lab	0	0	2	1
6	18CMCHL2060	Engineering Chemistry Lab	0	0	3	1.5
7	18CMEEL2070	Basic Electrical Engineering Lab	0	0	3	1.5
					Total Credits	**19**
Constitution of India, professional ethics & human rights (Non -Credit course)						

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I -B.Tech I- Semester Course structure for the Academic Year 2018-2019

Common for ME/CE/EEE

S.No.	Subject Code	Subject title	L	T	P	C
1	18CMEGT1010	Technical English	3	0	0	3
2	18CMMAT1020	Engineering Mathematics-I	3	1	0	4
3	18CMCHT1030	Engineering Chemistry	3	1	0	4
4	18CMEET1040	Basic Electrical Engineering	3	1	0	4
5	18CMEGL1050	English Communication skills lab	0	0	2	1
6	18CMCHL1060	Engineering Chemistry Lab	0	0	3	1.5
7	18CMEEL1070	Basic Electrical Engineering Lab	0	0	3	1.5
					Total Credits	**19**
Constitution of India, professional ethics & human rights (Non -Credit course)						

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I B.Tech II Semester Course structure for the Academic Year 2018-2019

Common for ME/CE/EEE

S. No.	Subject Code	Subject title	L	T	P	C
1	18CMMAT2010	Engineering Mathematics II	3	1	0	4
2	18EEPHT2020, 18MEPHT2020, 18CEPHT2020	Engineering Physics	3	1	0	4
3	18CMCST2030	Programming for problem solving	3	0	0	3
4	18CMMEL2040	Engineering Graphics	1	0	4	3
5	18EEPHL2050, 18MEPHL2050, 18CEPHL2050	Engineering Physics Lab	0	0	3	1.5
6	18CMCSL2060	Programming for problem solving lab	0	0	4	2
7	18CMMEL2070	Work Shop/Manufacturing practice	0	0	3	1.5
					Total Credits	**19**
Environmental Science (Non -Credit course)						

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ENGINEERING MATHEMATICS-I
(Syllabus for the academic year 2018 -2019)
Common to all the branches
SEMESTER - I/I

Subject Code	18CMMAT1010	IA Marks	30
Number of Lecture Hours/Week	3+ 1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 04

Course Objectives:
To enable the students to apply the knowledge of Mathematics in various engineering fields by making them to learn the following:

1. To solve first order differential equations.
2. To solve linear differential equations with constant coefficients.
3. To find the extrema of a function.
4. To solve partial differential equations
5. To evaluate multiple integrals
6. To verify vector integral theorems

Unit -1	
First order and first degree Ordinary Differential Equations Exact, reducible to exact, linear and Bernoulli's differential equations. Orthogonal trajectories in Cartesian and polar form. Simple problems on Newton's law of cooling. Law of natural growth and decay.	**Hours – 10**
Unit -2	
Linear differential equations with constant coefficients: Solutions of second and higher order differential equations - inverse differential operator methods, Method of variation of parameters. Application: LCR Circuits	**Hours – 8**
Unit – 3	
Partial derivatives – Definition and Euler's theorem (without proof), total derivatives, partial differentiation of	**Hours – 10**

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composite functions. Jacobian - Functional dependence. Taylor's and Maclaurin's theorems for function of two variables (statement only). Maxima and minima-Lagranges method of undetermined multipliers	
Unit – 4	
First order Partial differential equations: Formation of Partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear (Lagrange) equation and non linear (standard type) equations **Higher order Partial differential equations:** Solutions of Homogeneous and Non Homogeneous partial differential equations with constant coefficients – Classification of partial differential equations.	**Hours – 10**
Unit – 5	
Double and triple integrals: Evaluation of double and triple integrals. Evaluation of double integrals by changing the order of integration and by changing into polar co-ordinates. Beta and gamma functions and their properties **Vector Calculus** – Gradient – Divergence - Curl - Line integrals-definition and problems, surface and volume integrals definition, Green's theorem in a plane, Stokes and Gauss-divergence theorems (without proof) and problems.	**Hours – 12**
Course outcomes: On completion of this course, students are able to 1. Solve first order differential equations. 2. Solve linear differential equations with constant coefficients. 3. Find the extrema of a function. 4. Solve partial differential equations 5. Evaluate multiple integrals 6. Verify vector integral theorems	
Question paper pattern: **Section A:** 1. This section contains ten one or two line answer question	

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carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions.
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. B.S. Grewal, **"Higher Engineering Mathematics"**, Khanna publishers, 44th edition, 2016.
2. Erwin Kreyszig, **"Advanced Engineering Mathematics**, Wiley, 9th edition, 2013.

Reference Books:

1. B.V. Ramana, **"Higher Engineering M athematics"**, Tata Mc Graw-Hill, 2006
2. N.P.Bali and Manish Goyal, **"A text book of Engineering mathematics"**, Laxmi publications, latest edition.
3. H.K. Dass and Er. RajnishVerma, **"Higher Engineerig Mathematics"**, S.Chand publishing, 1st edition, 2011.

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
5	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-

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<table>
<tr><td colspan="4">Common to CSE,IT & EEE</td></tr>
<tr><td colspan="4">ENGINEERING PHYSICS
Semiconductor Physics & Semiconductor Optoelectronics
(Syllabus for the academic year 2018 -19)</td></tr>
<tr><td>Subject Code</td><td>18CSPHT1020,
18ITPHT1020,
18EEPHT2020</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3+1(T)</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 04</td></tr>
<tr><td colspan="4">COURSE OBJECTIVES:
The objectives of this course, help the students
• To impart the knowledge of Quantum mechanics for understanding the conducting mechanism in solids
• To understand the physics of semiconductors and their working mechanism for their utility.</td></tr>
<tr><td colspan="3">Unit -1</td><td></td></tr>
<tr><td colspan="3">Electronic materials
Free electron theory , Classical &Quantum theory, Density of states, Fermi level, Occupation probability, Bloch theorem, Kronig-Penny model (to introduce origin of band gap), E-k diagram and Effective mass. Types of electronic materials: metals, semiconductors, and insulators.</td><td>Hours – 12</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">Semiconductors
Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Hall effect and its applications.</td><td>Hours – 10</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="3">Light-semiconductor interaction
Types of Semiconductor materials of interest for</td><td></td></tr>
</table>

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optoelectronic devices, band gap modification, Hetero structures; Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint density of states, Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect.	**Hours –10**
Unit – 4	
Semiconductor light emitting diodes (LEDs) Direct and indirect band gap semiconductors, Injection Electro luminescence, LED: Device structure, materials, characteristics, Laser diode, Quantum well, wire, and dot based lasers.	**Hours – 9**
Unit – 5	
Unit-5: Photodetectors & Low-dimensional optoelectronic devices General properties of Photo detectors, Photo conductors, Types of semiconductor photo detectors -p-n junction, PIN, and Avalanche and their structure, materials, working principle, and characteristics, Noise limits on performance; Solar cells.	**Hours – 9**
COURSE OUTCOMES: On completion of the course student will able to 1. Understanding the conducting mechanism in metals using free electron theory and quantum mechanics 2. Estimate the concentration of charge carriers using Fermi level in semiconductors. 3. Understanding light-semiconductor interaction 4. Illustrate the working function of LEDs and diode lasers. 5. Illustrate the working function of photo detectors. 6. Illustrate the working function of solar cells.	
QUESTION PAPER PATTERN: **SECTION A:** 1. This section contains ten one sentence answer questions, each carrying 1 mark. 2. Two questions from each unit should be designed.	

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SECTION B:

1. This section will have 5 questions with internal choice.
2. Each question carries 12 marks.

Each full question comprises sub questions covering all topics under a unit.

TEXT BOOKS:

1. S.O. Pillai, Solid state physics, New age publications.
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons,

REFERENCE BOOKS:

1. Ch. Srinivas, Ch. Seshubabu, Engineering Physics, Cengage learning publications.
2. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
3. Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL
4. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL

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COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-	-	-	-
2	**3**	**2**	**1**	**3**	-	-	-	-	-	-	-	-	-	-	-
3	**3**	**1**	**1**	-	-	-	-	-	-	-	-	-	-	-	-
4	**3**	**1**	**2**	**3**	-	-	-	-	-	-	-	-	-	-	-
5	**3**	**1**	**2**	**3**	-	-	-	-	-	-	-	-	-	-	-
6	**3**	**1**	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**2**	**2**	**2**	-	-	-	-	-	-	-	-	-	-	-

Electronics & Communication Engineering (ECE)			
ENGINEERING PHYSICS **(Introduction to Electromagnetic Theory)** (Syllabus for the academic year 2018 -19)			
Subject Code	18ECPHT1020	IA Marks	30
Number of Lecture Hours/Week	3+1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
			Credits – 4

COURSE OBJECTIVES:

The objectives of this course, help the students:

- To impart the knowledge of Electrostatics and Magneto statics in vacuum and in dielectric medium.
- To impart the knowledge of Maxwell's equations to understanding the propagation of EM waves.

Unit -1	
Electrostatics in vacuum: Calculation of electric field and electrostatic potential for a charge distributions; Divergence and curl of electrostatic field; Energy of a charge distribution and its expression in terms of electric field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution, Method of images; Boundary conditions of electric field and electrostatic potential.	**Hours – 11**
Unit -2	
Electrostatics in a linear dielectric medium: Electrostatic field and potential of a dipole, Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the center of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.	**Hours – 9**

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Unit – 3	
Magnetostatics: Biot- Savart's law, Magnetic field on the axis of a current loop, Magnetic field induction due to a solenoid, Divergence and curl of static magnetic field; Vector potential and calculating it for a given magnetic field using Stokes' theorem; Equation for the vector potential and its solution for given current densities. Ampere's circuital law, Amperian loop, Differential form of Ampere's circuital law, Motion of charged particle in electrical field and in magnetic field, Hall effect.	**Hours –11**
Unit – 4	
Faraday's law: Faraday's law in terms of EMF produced by changing magnetic flux; Equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; Energy stored in a magnetic field. **Displacement current, Magnetic field due to time-dependent electric field** Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; Displace current and magnetic field arising from time dependent electric field; Calculating magnetic field due to changing electric fields in quasi static approximation.	**Hours – 10**
Unit – 5	
Maxwell's equations: Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector with examples, Qualitative discussion of momentum in electromagnetic fields. **Electromagnetic waves:** The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; Relation between electric and magnetic	**Hours – 9**

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fields of an electromagnetic wave; Energy carried by electromagnetic waves and examples, Momentum carried by electromagnetic waves and resultant pressure, Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.	

COURSE OUTCOMES:

On completion of the course student will able to

1. Calculate the electric field intensity and electrostatic potential for a charge distribution.
2. Solve the electrostatics problems in presence of dielectrics.
3. Calculate the magnetic field induction using the Biot-Savart's law.
4. Calculate the magnetic fields due to time varying electrical fields.
5. Derive the relation between electrical field intensity and time varying magnetic fields.
6. Apply Maxwell's equations to understanding the propagation of EM wave in vacuum and non-conducting medium.

QUESTION PAPER PATTERN:

SECTION A:

1. This section contains ten one sentence answer questions, each carrying 1 mark.
2. Two questions from each unit should be designed.

SECTION B:

3. This section will have 5 questions with internal choice.
4. Each question carries 12 marks.

Each full question comprises sub questions covering all topics under a unit.

TEXT BOOKS:

1. Saroj K. Dash, Smaruti R. Khuntia, Fundamentals of

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Electromagnetic theory.
2. David Griffiths, Introduction to Electrodynamics.

REFERENCE BOOKS:

1. Ch. Srinivas, Ch. Seshubabu, Engineering Physics, Cengage learning.
2. W. Saslow, Electricity, magnetism and light.
3. S.L Gupta& D.L. Gupta, Unified physics.

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-	-	-	-
2	**3**	**2**	**1**	**3**	-	-	-	-	-	-	-	-	-	-	-
3	**3**	**2**	**1**	**3**	-	-	-	-	-	-	-	-	-	-	-
4	**3**	**2**	**1**	**3**	-	-	-	-	-	-	-	-	-	-	-
5	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-	-	-	-
6	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**2**	**3**	**1**	-	-	-	-	-	-	-	-	-	-	-

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Common to Civil Engineering(CE) and Mechanical Engineering (ME)

ENGINEERING PHYSICS **(Mechanics)** (Syllabus for the academic year 2018 -19)			
Subject Code	18MEPHT2020, 18CEPHT2020	IA Marks	30
Number of Lecture Hours/Week	3+1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
			Credits – 04

COURSE OBJECTIVES:

The objectives of this course, help the students

- To impart the knowledge of Newton's law of motion in central force field
- To understand the Motion of rigid body systems in a Non inertial frames of reference
- To describe the Rigid body dynamics

Unit -1	
One Dimensional motion Newton's law, Equation of motion in one dimension, Invariance of Newton's equations-under shift of coordinate system rotation of coordinate system, time translation, Time reversal, Mirror reflection, Galileo transformation, Accelerating frames of reference. Simple harmonic motion-Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly-damped oscillators; Forced oscillations and resonance.	**Hours – 10**
Unit -2	
Two dimensional motion Two Dimensional motion in the Cartesian coordinate	**Hours – 9**

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system and in the radial polar coordinate system, Kepler's law, Kepler's problem of planetary motion and its solutions , Classification of Kepler's orbits.	
Unit -3	
Three dimensional motion Three dimensional motion in the Cartesian coordinate system –Example of Motion of charged particle, motion in non referential plane- Accelerating reference plane along a straight plane, Reference frame rotating with a constant angular velocity, Earth as a reference frame- study of the effects of earth rotations-Apparent gravitational acceleration, Effect of Coriolis force on terrestrial experiments and freely falling body.	**Hours – 10**
Unit – 4	
Conservative and non conservative force fields: Conservative and non conservative force fields, Gradient of a potential field, Curl of a vector field, Newton equations for variable mass system (rocket), System of particles and centre of mass.	**Hours – 9**
Unit – 5	
Rigid body dynamics Angular momentum of a single particle and system of particle, Definition of a rigid body, Equation of motion of rigid body, Euler's equation describing rigid body motion, Angular velocity, Kinetic energy of rigid body and moment of inertia, Parallel axis theorem.	**Hours – 10**
COURSE OUTCOMES: On completion of the course student will able to **1.** Understand the conditions for invariance and non invariance of Newton's second law. **2.** Distinguish the various harmonic motions and resonance. **3.** Apply Kepler's laws to understand the planetary motions. **4.** Formulate Five-term acceleration formula with consideration of earth rotation effect. **5.** Understanding the concept of conservative and non	

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conservative force fields.

6. Describe the rigid body dynamics and moment of inertia.

QUESTION PAPER PATTERN:

SECTION A:

1. This section contains ten one sentence answer questions, each carrying 1 mark.
2. Two questions from each unit should be designed.

SECTION B:

1. This section will have 5 questions with internal choice.
2. Each question carries 12 marks.
3. Each full question comprises sub questions covering all topics under a unit.

TEXT BOOKS:

1. Introduction to Mechanics — MK Verma.
2. An Introduction to Mechanics — D Kleppner & R Kolenkow.

REFERENCE BOOKS:

1. Principles of Mechanics — JL Synge & BA Griffiths.

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COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-	-	-	-
2	**3**	**2**	**1**	**3**	-	-	-	-	-	-	-	-	-	-	-
3	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-	-	-	-
4	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-	-	-	-
5	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-	-	-	-
6	**3**	**2**	**1**	**3**	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**2**	**1**	**1**	-	-	-	-	-	-	-	-	-	-	-

PROGRAMMING FOR PROBLEM SOLVING (Common for all branches)			
Subject Code:	18CMCST1030	IA Marks	30
Number of Lecture Hours/Week	3+1(T)	EA Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Unit-I: Introduction to computer systems and programming	**Teaching Hours**
History & Hardware: Computer Hardware, components, Types of Software, Memory units. **Introduction to Problem solving:** Algorithm, characteristics of Algorithms, Basic operations of algorithms, Pseudocode, Flowchart, Types of languages, Relation between Data, Information, Input and Output. **Basics of C:** History and Features of C, Importance of C, Procedural Language, Compiler versus Interpreter, Structure of C Program, Program development steps, programming errors.	**Hours- 08**
Unit-II: C Expressions, evaluation and control statements	
Overview of C: Character Set, C-Tokens, Data Types, Variables, Constants, Operators, Operator precedence and Associativity, converting mathematical expressions to C-expressions, evaluation of C-expressions, Input/output functions. **Conditional Branching:** if statement, if...else statement, Nested if...else statement, if…else…if ladder, switch statement. **Unconditional Branching:** goto. **Control flow statements:** break, continue. **Looping Constructs:** do-while statement, while statement, for statement.	**Hours- 12**

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Unit-III: Arrays and Functions	
Arrays: Introduction, 1-D Arrays, Character arrays and string representation, 2-D Arrays (Matrix), Multi-Dimensional Arrays. **Functions**: Basics, necessity and advantages, Types of functions, Parameter passing mechanisms, Recursion, Storage Classes, Command Line Arguments, Conversion from Recursion to Iteration and vice-versa. **Strings:** Working with strings, String Handling Functions (both library and user defined).	**Hours -10**
Unit-IV: Derived and User Defined Data types	
Pointers: Understanding Pointers, Pointer expressions, Pointer and Arrays, Pointers and Strings, Pointers to Functions. **Dynamic Memory Allocation:** Introduction to Dynamic Memory Allocation malloc, calloc, realloc, free. **Structures and Unions:** Defining a Structure, typedef, Advantage of Structure, Nested structures, Arrays of Structures, Structures and Arrays, Structures and Functions, Structures and Pointers, Defining Unions, Union within union, Structure within union, Union within structure, self-referential structures, bitfields, enumerations.	**Hours -12**
Unit-V: Preprocessing and File Handling	
Preprocessing Directives: Macro Substitution, File Inclusion, conditional compilation and other directives **File Management in C:** Introduction to File Management, Modes and Operations on Files, Types of files, Error Handling During I/O Operations.	**Hours -08**
Text Books: 1. Computer Programing ANSI C, E Balagurusamy, Mc Graw Hill Education(Private), Limited (TB1) 2. Programming in C, Reema Thareja, Second Edition, Oxford Higher Education (TB2)	

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Reference Books:

1. Computer Basics and C Programming, V Raja Raman, Second Edition, PHI (RB1)

Course Outcomes:

Student can able to

1) formulate algorithms, translate them into programs and correct program errors.
2) choose right control structures suitable for the problem to be solved.
3) decompose reusable code in a program into functions.
4) make use of arrays, pointers, structures and unions effectively.
5) store and retrieve data from permanent storage.
6) learn file operations

Question paper pattern:

Section A:

1. This section contains ten
2. one or two-line answer question carrying 1 mark each.
3. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions.
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

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COs VS POs MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	2	3	1		3									
2	2	3	3		1									
3	3	2	3		1									
4	2	2	3		1									
5	2	2	2											
6	2	2	2		1									
Course	2	2	3		2									

ENGINEERING GRAPHICS			
Subject Code	**18CMMEL1040/2040**	IA Marks	30
Number of Lecture Hours/Week	1(L)+04(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
			Credits – 03

COURSE OBJECTIVES:

1. Students should be able to construct Polygons using general methods, inscribe and describe polygons on circles, draw curves (parabola, ellipse and hyperbola, cycloids, involutes by general methods
2. Students should be able to read, interpret and construct plain scales, diagonal scales and vernier scales
3. Student should be able to draw orthographic projections of points, lines, Planes & Solids inclined to one reference plane. Students are should be able to apply various concepts to solve practical problems related to engineering.
4. Student should be able to draw sections and sectional views of Solids
5. Student should be able to draw isometric view of lines, plane figures and simple solids. Student should be able to convert given isometric views into orthographic views. Students should be able to apply various concepts to solve practical problems related to engineering
6. Student should be able to draw objects using draw and modify toolbars of AutoCAD

Unit -1	
Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections – Ellipse, Parabola, Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;	**Hours– 10**

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Unit -2	
Projections of Points and lines inclined to both planes; Projections of planes inclined to one plane	**Hours– 08**
Unit – 3	
Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes	**Hours– 10**
Unit – 4	
Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone	**Hours– 10**
Unit – 5	
Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions **Introduction to AUTOCAD**-The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows	**Hours– 12**

COURSE OUTCOMES:

1. Students will be able to construct Polygons using general methods, inscribe and describe polygons on circles, draw curves (parabola, ellipse and hyperbola, cycloids, involutes by general methods
2. Students will be able to read, interpret and construct plain scales, diagonal scales and vernier scales
3. Student will be able to draw orthographic projections of points, lines, Planes & Solids inclined to one reference plane. Students will be able to apply various concepts to solve practical problems related to engineering.
4. Student will be able to draw sections and sectional views of Solids
5. Student will be able to draw isometric view of lines, plane figures and simple solids. Student will be able to convert given isometric views into orthographic views. Students will be able to apply various concepts to solve practical problems related to

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engineering
6. Student will be able to draw objects using draw and modify toolbars of AutoCAD

QUESTION PAPER PATTERN:

SECTION A: (14M)

1. This section contains four questions carrying different weightage.

SECTION B: (4x14=56M)

1. This section will have 5 questions with internal choice.
2. Each full question carries 14 marks.
3. Each full question will have sub question covering all topics under a unit.

Text/Reference Books:

1. Engineering Drawing by N.D. Bhatt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers
3. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
4. Engineering Graphics for Degree by K.C. John, PHI Publishers

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COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	2		3							3		2			
2	2		3							3		2			
3	2		3							3		2			
4	2		3							3		2			
5	2		3							3		2		2	
6	2		3							3		2		2	
Over all	2		3							3		2		2	

Common to CSE, IT &EEE

ENGINEERING PHYSICS LABORATORY (Syllabus for the academic year 2018 -19)			
Subject Code	18CSPHL1050, 18ITPHL1050, 18EEPHL2050	IA Marks	50
Number of Practice Hours/Week	03	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
			Credits – 1.5

COURSE OBJECTIVES:

The objectives of this course, help the students

- To apply the theoretical knowledge of Physics through hands on the experimental instruments
- To improve the experimental knowledge in the later studies
- To understand the basic need of experiments.
- To know how to measure the different physical quantities.
- To gain the knowledge about different electrical components and basic electrical circuits.

List of Experiments

1. To study atomic levels in Neon- Argon gasses-Franc hertz experiment.
2. To determine resistivity of wire using four probe methods.
3. To determine the Boltzmann constant using PN junction diode.
4. To determine the Energy band gap of P-N junction diode.
5. To determine the Hall coefficient-Hall effect
6. To study the spectral response of photo diode-Planck's constant
7. To draw the LED current-voltage characteristics.
8. To draw the diode laser (LD) current-voltage characteristics.
9. To draw the Photo diode current-voltage characteristics.
10. To measure the current-voltage characteristics of a solar cell (Photovoltaic cell) at different light intensities.

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COURSE OUTCOMES:

On completion of the course student will able to

1. Understand the existence of the energy levels in gasses
2. Study the resistivity variation with temperature in conductor
3. Determine the energy band gap of semiconductor diode.
4. Understand the phenomenon of Hall effect
5. Understand the interaction of the light with semiconductor
6. Study the characteristic curves of the LEDs, LD & Solar cells.

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	**3**	**1**	**-**	**3**	-	-	-	-	-	-	-	-	-	-	-
2	**3**	**1**	**-**	**3**	-	-	-	-	-	-	-	-	-	-	-
3	**3**	**1**	**-**	**3**	-	-	-	-	-	-	-	-	-	-	-
4	**3**	**1**	**-**	**3**	-	-	-	-	-	-	-	-	-	-	-
5	**3**	**1**	**-**	**3**	-	-	-	-	-	-	-	-	-	-	-
6	**3**	**1**	**-**	**3**	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**1**	**-**	**3**	-	-	-	-	-	-	-	-	-	-	-

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Electronics &Communication Engineering (ECE)

ENGINEERING PHYSICS LABORATORY (Syllabus for the academic year 2018 -19)			
Subject Code	18ECPHL1050	IA Marks	50
Number of Practice Hours/Week	03	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
			Credits – 1.5

COURSE OBJECTIVES:

The objectives of this course, help the students

- To apply the theoretical knowledge of Physics through hands on the experimental instruments
- To improve the experimental knowledge in the later studies
- To understand the basic need of experiments.
- To know how to measure the different physical quantities.
- To gain the knowledge about different electrical components and basic electrical circuits.

List of Experiments

1. To determine the static potentials and the accompanying electric field intensities of different diameters of electrically charged conducting sphere.
2. To determine the strength of the uniform electric field produced between the charged plates of a plate capacitor.
3. To determine the dielectric constant of a medium (plastic or glass) filling between the plates of the capacitor of a plate capacitor.
4. To measure the magnetic field induction of circular coil-Stewart-Gee's experiment.
5. To measure the spatial distribution of the field strength between a pair of coils in the Helmholtz arrangement.
6. To investigated the relation between magnetic field strength and coils of different dimensions using Hall probe (Tesla meter).

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7. To determine Self Inductance of a Coil by Anderson's Bridge using AC.
8. To study the motion of charged particle in electric and magnetic fields and determine the value of e/m by magnetic focusing.
9. To determine Hall coefficient and estimate the concentration of charge carriers using Hall Effect.
10. To study the interaction of EM waves with matter and determine value of Planck's constant using LEDs of at least 4 different colors.

COURSE OUTCOMES:

On completion of the course student will able to

1. Determine the electrostatic field and static potentials.
2. Apply the Biot- Savart's law in case of circular coils.
3. Determine the self inductance of a coil.
4. Measure e/m value of a charged particle in electrical and magnetic fields.
5. Determine the Hall coefficient using the phenomenon of Hall Effect.
6. Understand the particle behavior of EM wave when it interacts with matter.

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COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PS O 2	PSO 3
1	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
2	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
3	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
4	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
5	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
6	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
Cou rse	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-

Common to CE&ME

ENGINEERING PHYSICS LABORATORY (Syllabus for the academic year 2018 -19)			
Subject Code	18CEPHL2050, 18MEPHL2050	IA Marks	50
Number of Practice Hours/Week	03	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
			Credits – 1.5

COURSE OBJECTIVES:

The objectives of this course, help the students

- To apply the theoretical knowledge of Physics through hands on the experimental instruments
- To improve the experimental knowledge in the later studies
- To understand the basic need of experiments.
- To know how to measure the different physical quantities.

List of Experiments

1. To investigate the Motion of Coupled Oscillators
2. To determine the rigidity modulus η of wire-Torsional pendulum.
3. To determine acceleration due to gravity *g* and radius of gyration *K* - Compound pendulum.
4. To determine the Frequency of an electrically maintained tuning fork by Melde's Experiment.
5. To determine the velocity of sound in air-Volume resonator.
6. To verify the transverse law of vibrations-Sonometer.
7. To determine the young's modulus and draw load depression graph in uniform bending.
8. To determine the Moment of Inertia of a Flywheel.
9. To verify the parallel axis and perpendicular axis theorems and determine the moment of inertia of a regular rectangular body -Bifilar pendulum.
10. To study of oscillations-Spiral spring.

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COURSE OUTCOMES:

On completion of the course student will able to

1. Study the mode of vibrations in Coupled Oscillators
2. Determine the g & η values using the knowledge in simple harmonic motions.
3. Apply the phenomenon of resonance to verify the transverse laws of stretched string.
4. Determine the frequency of vibrating body, velocity of sound in air using resonance.
5. Determine the moment of inertia of a rigid body.
6. Verify the parallel axis and perpendicular theorems of moment of inertia.

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PS O 2	PSO 3
1	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
2	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
3	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
4	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
5	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
6	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
Cour se	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-

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PROGRAMMING FOR PROBLEM SOLVING LAB (Common for all branches)			
Subject Code	18CMCSL1060	IA Marks	50
Number of Practice Hours/Week	03	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
			Credits - 02

Objectives:

- To apply programming for basic mathematical functions
- To design and program mathematical concepts.
- To create and use the functions and library functions
- Able to apply the theoretical knowledge of formatting of documents
- To create and apply user defined types to the real world problems.
- To create files and shapes of the concepts.

List of Experiments

Exercise 1 (Familiarization with programming environment)

a) Familiarization of CODE BLOCKS C++ Editor to edit, compile, execute, test and debugging C programs.
b) Familiarization of RAPTOR Tool to draw flow charts and understand flow of control.
c) Acquittance with basic LINUX commands.

Exercise 2 (Simple computational problems using arithmetic expressions)

a) Write a C Program to display real number with 2 decimal places.
b) Write a C Program to convert Celsius to Fahrenheit and vice versa.
c) Write a C Program to calculate the area of triangle using the formula

area = $\sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$

d) Write a C program to find the largest of three numbers using ternary operator.
e) Write a C Program to swap two numbers without using a

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temporary variable.

Exercise 3 (Problems involving if-then-else structures)

a) Write a C Program to check whether a given number is even or odd using bitwise operator, shift operator and arithmetic operator.
b) Write a C program to find the roots of a quadratic equation.
c) Write a C Program to display grade based on 6 subject marks using if…else…if ladder.
d) Write a C program, which takes two integer operands and one operator form the user, performs the operation and then
e) prints the result using switch control statement. (Consider the operators +, -, *, /, %)

Exercise 4 (Iterative problems)

a) Write a C Program to count number of 0's and 1's in a binary representation of a given number.
b) Write a C program to generate all the prime numbers between two numbers supplied by the user.
c) Write a C Program to print the multiplication table corresponding to number supplied as input.

Exercise 5 (Iterative problems)

a) Write a C Program to Find Whether the Given Number is
i) Armstrong Number ii) Palindrome Number
b) Write a C Program to print sum of digits of a given number

Exercise 6 (Series examples)

a) Write a C Program to calculate sum of following series
b) 1+2+3+…. n b)1+1/2+1/3+……+1/n
c)$1+x+x^2+x^3……+x^n$

Exercise 7 (1D Array manipulation)

a) Write a C program to interchange the largest and smallest numbers in the array.
b) Write a C program to search an element in an array (linear search).
c) Write a C Program to print the following pattern using a character array

S
SA
SAS

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SASI

Exercise 8 (Matrix problems, String operations)

a) Write a C program to add two matrices.
b) Write a C program to multiply two matrices if they are compatible or print an error message "incompatible matrix sizes" otherwise.
c) Write a C program to check given matrix is symmetric or not.
d) Implement the following string operations with and without library functions.
i) copy ii) concatenate iii) length iv) compare

Exercise 9 (Simple functions)

a) Write a C Program demonstrating the following function types
i. With arguments and with return value.
ii. With arguments and without return value
iii. Without arguments and without return value.
iv. Without arguments and with return value.
b) Write a C Program illustrating call by reference

Exercise 10 (Recursive functions)

Write a C Program illustrating the following with Recursion without Recursion

a) Factorial b) GCD c) Power d) Fibonacci

Exercise 11(Pointers and structures)

a) Write a C program to find sum of n elements entered by user. To perform this program,
allocate memory dynamically using malloc () function.
b) Write a C program to find sum of n elements entered by user. To perform this program,
allocate memory dynamically using calloc () function.
Note: Understand the difference between the above two programs.
c) Write a C Program to read and print student details using structures.

Exercise 12 (File operations)

a) Write a C program to open a file and to print it contents on screen.

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b) Write a C program to copy files
c) Write a C program merges two files onto a new file.
d) Write a C program to delete a file.

COURSE OUTCOMES:

1. Attain knowledge on using CODE BLOCKS and RAPTOR tools in solving problems.
2. Examine and analyze alternative solutions to a problem.
3. Design an algorithmic solution to a problem using problem decomposition and step-wise refinement.
4. Demonstrate conversion of iterative functions to recursive and vice-versa.
5. Implement the concepts of arrays.
6. Implement the structures, Unions and files.

COs VS POs

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	3	3	3		3									
2	2	3	3		2									
3	2	3	3		2									
4	2	3	3		2									
5	2	3	3		2									
6	2	3	3		2									
Course	2	3	3		2									

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WORKSHOP/MANUFACTURING PRACTICE (Syllabus for the academic year 2018 -19)			
Subject Code	18CMMEL1070/2070	IA Marks	50
Number of Practice Hours/Week	01(L)+4(P)	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
			Credits – 64

COURSE OBJECTIVES:

1. Students should be able to learn the basic manufacturing processes, study the various tools and equipment used and gain hands-on experience in different trades.
2. Students should be able to learn the engineering and technology involved in carpentry, fitting, black smithy, foundry, welding, machining and plastic moulding.
3. Students should understand the workmanship required, working of machinery or equipment necessary.

i. Lectures & videos: (10 hours)

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures)**
2. CNC machining, Additive manufacturing **(1 lecture)**
3. Fitting operations & power tools **(1 lecture)**
4. Electrical & Electronics **(1 lecture)**
5. Carpentry **(1 lecture)**
6. Plastic moulding, glass cutting **(1 lecture)**
7. Metal casting **(1 lecture)**
8. Welding (arc welding & gas welding), brazing **(1 lecture)**

ii. Workshop Practice:

Sl. NO.	Name of Shop floor	Exercises
1.	Blacksmithy	1. S-Hook
		2. Square Rod To Round Rod
2.	Carpentry	1. T-Lap Joint
		2. Cross Lap Joint
3.	Foundry	1. Mould for a Solid

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		2. Mould for a Split Pattern.
4.	Fitting	1. Square Fitting
		2. V-Fitting
5.	Welding	1. Butt Joint
		2. Lap Joint
6.	Machine Tools	1. Turning
		2. Knurling
7.	Plastic Moulding	1. Key chain

COURSE OUTCOMES:

1. Students will be able to make use of basic carpentry joints to make furniture.
2. Students will be able to fabricate mechanical engineering assemblies using fitting joints.
3. Students will be able to produce various machine components by using foundry, black smithy, machining and plastic moulding techniques.

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COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3														
2	3														
3	2				1				1						
Course	3				1				1						

ENVIRONMENTAL SCIENCE			
Subject Code	18CMCHN1080/2080	IA Marks	30
Number of Lecture Hours/Week	04	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
			Credits – 00

COURSE OBJECTIVES:

The objectives of this course, help the students to

1. Know the importance of Environmental studies and the measures to be taken to overcome global environmental challenges.
2. Understand the concept of ecosystem and its diversity.
3. Gain knowledge on natural resources.
4. Understand the concept of biodiversity.
5. Gain knowledge on environmental pollution.
6. Gain knowledge on environmental legislation and global treaties.

Unit -1	
MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES **Environment** - Definition, Introduction - Scope and Importance - Global environmental challenges, global warming & climate change - Acid rains, ozone layer depletion - Carbon credits - Sustainability, Stockholm & Rio Summit - Population growth & explosion - Role of Information Technology in Environment and human health. **Ecosystem** - Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features,	**Hours – 10**

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structure and function of the different ecosystems	
Unit -2	
NATURAL RESOURCES Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation - Timber extraction – Mining, dams and other effects on forest and tribal people Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.	**Hours – 12**
Unit – 3	
BIODIVERSITY AND ITS CONSERVATION Introduction - Definition: genetic, species and ecosystem diversity. – Biogeographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss - Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	**Hours – 6**

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Unit – 4	
ENVIRONMENTAL POLLUTION Definition, Cause, effects and control measures of : a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution. - Pollution case studies.	**Hours – 12**
Unit – 5	
SOCIAL ISSUES AND THE ENVIRONMENT Urban problems related to energy -Water conservation, rain water harvesting, watershed management - Resettlement and rehabilitation of people its problems and concerns. Environment Protection Act - Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act -Issues involved in enforcement of environmental legislation. -Public awareness. **Field work:** Visit to a local area to document environmental assets River /forest grassland/hill/mountain -Visit to a local polluted site Urban/Rural/industrial/ Agricultural Study of common plants, insects, birds. - Study of simple ecosystems - pond, river, hill slopes, etc.	**Hours – 10**
COURSE OUTCOMES: On completion of the course student will be 1. Able to know the importance of Environmental studies and	

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the measures to be taken to overcome global environmental challenges.
2. Able to understand the concept of ecosystem and its diversity.
3. Able to gain knowledge on natural resources.
4. Able to understand the concept of biodiversity.
5. Able to gain knowledge on environmental pollution.
6. Gain knowledge on environmental legislation and global treaties.

QUESTION PAPER PATTERN:

SECTION A:

1. This section contains ten one answer question carrying 1 mark each.
2. Two questions from each unit should present.

SECTION B:

1. This section will have 5 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.

TEXT BOOKS:

1. E. Bharucha (2003), "Environmental Studies", University Publishing Company, New Delhi.
2. J.G. Henry and G.W. Heinke (2004), "Environmental Science and Engineering", Second Edition, Prentice Hall of India, New Delhi
3. G.M. Masters (2004)" Introduction to Environmental Engineering and Science", Second Edition, Prentice Hall of India, New Delhi

REFERENCE BOOKS:

1. Text Book of Environmental Studies by Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada.

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3. Environmental Studies, P.N. Paliniswamy, P. Manikandan, A. Geeta and K. Manjula Rani, Pearson Education, Chennai.

Course Outcomes to Program Outcomes Mapping:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	-	**3**	-	-	-	-	-	-	-	-
2	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-
4	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-	-
6	-	**3**		-	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**3**	**3**	-	-	-	**3**	-	-	-	-	-	-	-	-

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<table>
<tr><td colspan="4">TECHNICAL ENGLISH
(Syllabus for the academic year 2018-19)
Semester I/II</td></tr>
<tr><td>Subject Code</td><td>18CMEGT1010/2010</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/ Week</td><td>03</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exams Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits -02</td></tr>
<tr><td colspan="4">Course Objectives:

To enable the students to learn and apply fundamental principles in Technical English & Communication by focusing on:
1. Technical English Vocabulary
2. Writing Skills
3. Common Errors in Writing
4. Nature and Style of Sensible Technical Writing
5. Writing Technical Reports and Letters
6. Providing an inspiring reading experience from the biography of a renowned technocrat.</td></tr>
<tr><td colspan="4">Unit I</td></tr>
<tr><td colspan="3">Principles of Scientific Vocabulary
• Principles of Scientific vocabulary: short and simple words-compact substitutes for wordy phrases-redundant words and expressions-Avoid hackneyed and stilted phrases, verbosity and incorrect use of words
• The role of roots in word building,prefixes and suffixes, confusing words and expressions.
Non-detailed text-Karmayogi: 1-4 chapters, Page No 1-53</td><td>10 hours</td></tr>
<tr><td colspan="4">Unit II</td></tr>
<tr><td colspan="3">Writing Skills
• Distinguishing between academic and personal styles</td><td>10 hours</td></tr>
</table>

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of writing • Use of clauses in technical phrases and sentences • Techniques of Sentence and paragraph writing • Measuring the clarity of a text through Fog Index or Clarity Index Non-detailed text- Karmayogi: 5-8 chapters, Page No 54-100	
Unit III	
Common Errors in Writing • Subject-verb agreement and concord of nouns, pronouns and possessive adjectives • Common errors in the use of articles, prepositions, adjectives and adverbs • Punctuation • Technical Guidelines for Communication • **Avoiding the pitfalls** Non-detailed text-Karmayogi: 9-12 chapters, Page No101-151	10 hours
Unit IV	
Nature and Style of Sensible Technical Writing • Academic Writing Process • Describing, processes and products • Defining, Classifying • Effective use of charts, graphs, and tables Non-detailed text- Karmayogi: 13-16 chapters, Page No 152-203	10 hours
Unit V	
Report writing and Letter writing • Writing Technical Reports • Précis writing • Letter Writing • Essay writing Non-detailed text- Karmayogi: 13-16 chapters, Page No 204-250	10 Hours

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COURSE OUTCOMES

On Completion of the course student will acquire

1. Ability to understand Scientific vocabulary and use them confidently
2. Familiarity with the basic principles of writing clear sentences and paragraphs
3. Ability to write error free simple technical passages
4. Knowledge of writing different writing styles
5. Confidence to write letters and technical reports clearly and coherently
6. Get inspired by achievements and values upheld by a renowned technocrat.

Question Paper Pattern

Section –A

1. 10 questions carrying one mark each
2. Five questions each from Units I and III

Section –B

1. 5 questions carrying 12 marks each (one compulsory question from non-detailed text)
2. Each question will have two or three sub questions covering all the units

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Text Books

1. Effective Technical Communication by Barun K Mitra, Oxford University Publication

Non-detailed Text

1. Karmayogi: A Biography of E Sreedharan by M S Ashokan

Reference Books

1. *Communication Skills* by Sanjay Kumar &PushpaLatha, OUP
2. Study Writing by Liz Hamp-Lyons and Ben Heasly, Cambridge University Press.
3. Remedial English Grammar by F T Wood, Macmillian 2007
4. *Practical English Usage* by Michael SwanOxford University Press
5. *English Collocations in Use* by Michael McCarthy & Felicity O'Dell

6. *Effective Technical Communication* by Arsahf Rizvi,
7. *Essential English Grammar by Raymond Murphy, CUP, 2017*

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-	-

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ENGINEERING MATHEMATICS-II
(Syllabus for the academic year 2018 -2019)
Common to all the branches
SEMESTER - I/II

Subject Code	18CMMAT2020	IA Marks	30
Number of Lecture Hours/Week	3(L)+ 1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 04

Course objectives:
To enable students to apply the knowledge of Mathematics in various engineering fields by making them to learn the following

- To solve system of linear equations
- To find eigen values and eigen vectors of a matrix
- To solve initial value problems by using Laplace transforms
- To find the solution of algebraic/ transcendental equations and also interpolate the functions.
- To evaluate numerical integration and to solve ordinary differential equations by using numerical methods.
- To find Fourier series of a periodic function and to determine the Fourier transform of a function

Unit -1	
Linear Algebra: Rank of a matrix by elementary transformations, solution of system of linear equations - Gauss-elimination method, Gauss-Jordan method – Jacobi method and Gauss-Seidel method – Eigen values and Eigen vectors, Properties of Eigen values and Eigen vectors - Linear transformation, Diagonalisation of a square matrix. Cayley-Hamilton theorem (without proof) - Reduction of Quadratic form to Canonical form.	**10 Hours**
Unit -2	
Laplace Transforms: Laplace transforms of standard functions-Shifting theorems - Transforms of derivatives and integrals – Unit step function –Dirac's delta function Inverse Laplace transforms– Convolution theorem	**10 Hours**

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(without proof). Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms	
Unit – 3	
Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula- Falsi Method and Newton-Raphson method. Finite differences: Error functions – Forward, backward and central differences, Newton's forward and backward interpolation formulae. Gauss`s forward and backward interpolation formulae - Lagrange's interpolation formula (all formulae without proof)	**10 Hours**
Unit – 4	
Numerical integration: Trapezoidal rule - Simpson's (1/3)rd and (3/8)th rules. Numerical solutions of ordinary differential equations-Taylors series method-Picard's method-Eulers method-Modified Eulers method-Runge-Kutta methods	**8 Hours**
Unit – 5	
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period. Fourier series of even and odd functions, Half range Fourier Series. **Fourier Transforms**: Infinite Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier transforms.	**12 Hours**
Course outcomes: On completion of this course, students are able to, 1. Solve system of linear equations 2. Find eigen values and eigen vectors of a matrix 3. Solve initial value problems by using Laplace transforms 4. Find the solution of algebraic/ transcendental equations and also interpolate the functions. 5. Evaluate numerical integration and to solve ordinary differential equations by using numerical methods. 6. Find Fourier series of a periodic function and to determine the Fourier transform of a function	

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Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions.
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 44th Edition, 2016.
2. Kreyszig, "Advanced Engineering Mathematics " - Wiley, 9th Edition, 2013.

Reference Books:

1. B.V.Ramana "Higher Engineering M athematics" Tata Mc Graw-Hill, 2006
2. N P Bali and Manish Goyal, "A text book of Engineering mathematics", Laxmi publications, 7th edition.
3. H. K Dass and Er. Rajnish Verma ,"Higher Engineerig Mathematics", S. Chand publishing,1st edition, 2011.
4. Dr.K.V.Nageswara Reddy and Dr.B.Rama Bhupal Reddy, "Engineering Mathematics, Volume II" Scitech Publications, 2017.

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COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	3	-	-	-	-	-	-	-	-	-	-
2	2	3										
3	2	3	-	-	-	-	-	-	-	-	-	-
4	2	3	-	-	-	-	-	-	-	-	-	-
5	2	3	-	-	-	-	-	-	-	-	-	-
6	2	3	-	-	-	-	-	-	-	-	-	-
Course	2	3	-	-	-	-	-	-	-	-	-	-

ENGINEERING CHEMISTRY			
Subject Code	18CMCHT1030/2030	IA Marks	30
Number of Lecture Hours/Week	3(L) + 1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
			Credits – 04

COURSE OBJECTIVES:

The objectives of this course, help the students to

1. Rationalize periodic properties like ionization potential, electronegativity and oxidation states.
2. Apply the concepts of electrochemistry.
3. Analyze bulk properties and processes using thermodynamic considerations.
4. List major chemical reactions that are used in the synthesis of molecules.
5. Understand the concepts of atomic and molecular orbitals.
6. Know various spectroscopic techniques.

Unit -1	
PERIODIC PROPERTIES Effective nuclear charge of fluorine and magnesium, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, oxidation states, coordination numbers 2 & 3 and geometries, hard soft acids and bases.	**Hours – 10**
Unit -2	
USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA **Thermodynamic functions:** State and Path functions, First and second laws of thermodynamics, Gibbs Helmholtz Equation, concept of entropy and enthalpy.	**Hours – 10**

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Electro chemistry: Introduction, electrode potential, standard electrodes – Hydrogen and Calomel electrodes, Nernst equation and applications. **Water chemistry:** Surface and subsurface water quality parameters – turbidity, pH, total dissolved salts, chloride content, break point chlorination. **Corrosion:** Wet chemical theory, control methods – proper designing, cathodic protection- Sacrificial anodic and impressed current cathodic protection.	
Unit – 3	
STEREOCHEMISTRY Principles of stereochemistry, representations of 3 dimensional structures of organic compounds, geometrical and stereoisomers, configuration and symmetry, enantiomers. **ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE** Introduction to reactions involving Substitution – SN^1 & SN^2 with mechanism, Addition – Free radical, Elimination – E1 & E2 with examples (mechanism is not involved), Synthesis of aspirin drug molecule.	**Hours – 10**
Unit – 4	
ATOMIC, MOLECULAR STRUCTURE AND ADVANCED MATERIALS Schrodinger equation. Particle in a box solution and their applications for conjugated molecules. **Nanoparticles**: Introduction, preparation methods – Sol-gel method, Chemical reduction method – properties and applications. **Surface properties:** Determination of surface tension and viscosity of liquids. **Ceramics:** Classification, examples and applications. Crystal field theory and the energy level diagrams for	**Hours – 10**

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transition metal ions.	
Unit – 5	
SPECTROSCOPIC TECHNIQUES Regions of electromagnetic spectrum - Principles of vibrational and rotational spectroscopy. Vibrational and rotational spectroscopy of diatomic molecules: Rigid diatomic molecules - selection rule - simple Harmonic Oscillator - diatomic vibrating rotator. Nuclear magnetic resonance – Principle and Instrumentation. Principles of chromatography – TLC & Paper.	**Hours – 10**

COURSE OUTCOMES:

On completion of the course student will be

1. Able to rationalise periodic properties like ionization potential, electro negativity and oxidation states.
2. Able to know the nature and working of various electrodes.
3. Able to analyze bulk properties and processes using thermodynamic considerations.
4. Able to synthesize organic molecules using different types of chemical reactions.
5. Able to understand the concepts of atomic and molecular orbitals.
6. Able to gain knowledge on spectroscopic techniques and the ranges of the electromagnetic spectrum used for exciting different molecular energy levels.

QUESTION PAPER PATTERN:

SECTION A:

1. This section contains ten one answer questions carrying 1 mark each.
2. Two questions from each unit should present.

SECTION B:

1. This section will have 5 questions with internal choice.
2. Each full question carries 12 marks.

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3. Each full question will have sub question covering all topics under a unit.

TEXT BOOKS:

1. Stereochemistry of Carbon Compounds by Ernest Eliel; McGraw Hill Education.
2. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
3. Concise Inorganic Chemistry, J.D.Lee, 5th Edition; Wiley India.
4. Engineering Chemistry – Fundamentals and applications by Shikha Agarwal; Cambridge University Press
5. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp
6. Engineering Chemistry by Jain & Jain; Dhanpat Rai Publishing Company

REFERENCE BOOKS:

1. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishnan.
2. Physical Chemistry, by P. W. Atkins.
3. Physical Chemistry, by Glasstone, S
4. Advanced inorganic chemistry by Wilkinson G and Cotton FA

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
5	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

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BASIC ELECTRICAL ENGINEERING
Syllabus for the academic year 2018-2019
SEMESTER-I

Subject Code	18CMEET1040	IA Marks	30
Number of Lecture Hours/week	3(L)+1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 04

Course Objectives:

This course will enable student to :

- Describe the basics electrical circuit concepts and how to apply the various theorems for given electrical network
- Describe the representation of sinusoidal waveform and also analysis of single phase ac circuit with various elements
- Describe the principle and operation of ac and dc electrical machines
- Describe the basic operation of different converters circuits
- Describe the necessity of the batteries and importance of the basic switch gear unit

Module -1

DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenins and Norton Theorems (Simple numerical problems). Time-domain analysis of first-order RL and RC circuits.	**Hours-10**

Module – 2

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in	**Hours-10**

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star and delta connections.	
Module – 3	
Transformers Magnetic materials, BH characteristics, ideal and practical transformer , equivalent circuit , losses in transformers,OC and SC tests, regulation and efficiency. Auto transformer and three-phase transformer connections.	**Hours-10**
Module – 4	
Electrical Machines: Ac machines- Generation of rotating magnetic fields, construction details and working of three phase induction motor, significance of torque – slip characteristics. Loss components and efficiency, starting and speed control of induction motor. Single phase induction motor. Construction and working of synchronous generators. **DC machines-** Construction, working, torque- speed characteristics and speed control of dc shunt motor.	**Hours-10**
Module – 5	
Power Converters and Electrical Installations DC – DC Buck and boost converters, duty ratio control, PWM techniques, single phase voltage source inverters. Classification of batteries and Low Voltage switch gear.	**Hours-10**
Course outcomes: On completion of the course student will be 1. Able to analyze DC circuits by using KCL, KVL and Network theorems 2. Able to analyze AC circuits 3. Able to explain the operation and compute performance of transformer 4. Able to explain the construction and working of rotating electrical machines 5. Able to describe DC-DC and DC-AC converters 6. Able to explain about types of LV switch gear and types of batteries	

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Question paper pattern:

Section A :

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This section will have 10 questions.(Two questions from each unit)
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under unit
4. The student will have to answer 5 full questions selecting one full question from each unit.

Test books.

T1. E. Hughes, *"Electrical and Electronics Technology"*, Pearson, 2010.

T2.D.C. Kulshreshtha, *"Basic Electrical Engineering"*, McGraw Hill, 2009.

T3.D.P. Kothari, I.J. Nagrath, *"Basic Electrical Engineering"*, Tata McGraw Hill, 2010.

T4. J.P. Tewari, *"Basic Electrical Engineering"*, New Age International Publishers, 2003.

References

R1. M.D. Singh, *"Power Electronics"*, 2nd edition.

R2. *"Battery Energy Storage for Smart Grid Applications"*, Eurobat 2013.

R3. L.S. Bobrow, *"Fundamentals of Electrical Engineering"*, Oxford University Press, 1996.

R4. V.D. Toro, *"Electrical Engineering Fundamentals"*, Prentice Hall India, 1989.

R5. R.M. Dell, D.A.J. Rand, *"Understanding Batteries"*, 2001.

R6. Bhavesh Bhalja, R.P., Maheshwari, Nilesh G. Chothani, *"Protection and Switchgear"*, Oxford University Press, 5th impression, 2014.

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Course Outcomes to Program Outcomes mapping

COs / POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	3	3	1	0	0	0	0	0	0	0	0	0	0	0
2	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0
3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0
5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0
6	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Cours e	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0

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English Language Communication Skills Lab (syllabus for the academic year 2018 -2019)			
Subject Code	18CMEGL1050/2050	IA Marks	50
Number of Practical Hours/Week	02	Exam Marks	50
Total Number of Practical Hours	32	Exam Hours	03

Credits – 01

Objectives: To enable the students to learn communication skills of Listening, Speaking, Reading and Writing by focusing on:

- Listening Comprehension
- Pronunciation
- Functional English in formal and Informal Situations
- Interpersonal Communication Skills
- Presentation Skills

List of Experiments

UNIT I

Listening Comprehension

UNIT II

Pronunciation , Stress, Intonation & Rhythm

UNIT III

Common Everyday Situations: Conversations & Dialogues, Communication at Workplace

UNIT IV

Interpersonal Communication Skills- Group discussions and debates

UNIT V

Formal Presentations

Outcomes:

By the end of the course the students will be able to acquire basic Proficiency in English by practicing the following:

- Listening Comprehension
- Pronunciation
- Dialogues
- Interpersonal Communication Skills

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- Presentation Skills
- Discussions and Debates

Learning Resources:

- Interact – English Lab Manual for Undergraduate Students by Orient BlackSwan
- Ted Talks, Interviews with Achievers and select movies
- Toastmaster's speeches and table topics
- Book Reviews and movie reviews
- Exercises in Spoken English Parts: I-III, CIEFL, Hyderabad.
- Oxford Guide to Effective Writing and Speaking by John Seely
- https://www.ted.com/talk

Course Outcomes Vs Program Outcomes Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	-	-	-	-	-	-	-	-	-	2	-	-
2	-	-	-	-	-	-	-	-	-	3	-	-
3	-	-	-	-	-	-	-	-	-	3	-	-
4	-	-	-	-	-	-	-	-	-	2	-	-
5	-	-	-	-	-	-	-	-	-	3	-	-
6	-	-	-	-	-	-	-	-	-	2	-	-

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ENGINEERING CHEMISTRY LABORATORY (Syllabus for the academic year 2018 -19)			
Subject Code	18CMCHL1060/2060	IA Marks	50
Number of Practice Hours/Week	03	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03

Credits – 1.5

COURSE OBJECTIVES:

The objectives of this course, help the students to

1. Measure molecular properties like surface tension and viscosity
2. Determine chloride content of water of given water sample.
3. Familiarize the synthesis of a simple drug.
4. Determine rate constant as a function of time.
5. Determine the strength of acids using conductivity meter.
6. Determine amount of Fe (II) using potentiometer.

List of Experiments

(Any 10 experiments must be conducted)

1. Determination of surface tension
2. Determination of viscosity of a liquid by Ostwald viscometer
3. Thin layer chromatography
4. Determination of chloride content of water
5. Determination hardness of water by EDTA.
6. Determination of the rate constant of first order reaction (Ester hydrolysis)
7. Determination of strength of strong acid using conductometeric titration.
8. Determination of strength of weak acid using conductometeric titration .
9. Determination of Ferrous iron using potentiometer.
10. Synthesis of a drug – Aspirin
11. Determination of the partition coefficient of a substance

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between two immiscible liquids

12. Determination of strength of acetic acid using charcoal adsorption.

Demonstration Experiments:

1. Preparation of lattice structure and determination of atomic packing factor.
2. Chemical oscillations- Iodine clock reaction
3. Synthesis of Phenol formaldehyde resin
4. Saponification of oil

COURSE OUTCOMES:

On completion of the course student will be

1. Able to measure molecular properties like surface tension and viscosity
2. Able to determine chloride content of given water sample.
3. Able to synthesize a drug.
4. Able to determine rate constant as a function of time.
5. Able to determine strength of acids using conductivity meter.
6. Able to determine amount of Fe (II) using potentiometer.

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COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
1	-	3	-	-	-	-	-	-	-	-	-	-
2	-	3	-	-	-	-	-	-	-	-	-	-
3	-	3	-	-	-	-	-	-	-	-	-	-
4	3	-	-	-	-	-	-	-	-	-	-	-
5	-	3	-	-	-	-	-	-	-	-	-	-
6	-	3	-	-	-	-	-	-	-	-	-	-
Course	2	3	-	-	-	-	-	-	-	-	-	-

BASIC ELECTRICAL ENGINEERING LAB
(Syllabus for the academic year 2018 -2019)
SEMESTER-I

Subject Code	18CMEEL1070	IA Marks	50
Number of Practice Hours/Week	2P	Exam Marks	50
Total Number of Practice Hours	32	Exam Hours	03

Credits – 01

The objectives of this course, help the students to

1. Learn how to find the frequency response and resonance of RL & RC circuits
2. Learn how to verify the given networks using theorems
3. Learn how to measure the power and determination of efficiency of a single phase transformer and how to measure the power in three phase transformer
4. Learn how to determine the Torque-slip characteristics of a dc shunt and induction motors.
5. Learn how to find the regulation of an alternator
6. Learn the operation of different converter circuits and know about the switch gear system

List of Experiments (Any Ten experiments must be conducted)

1. Study of R-L,R-C,R-L-C circuits.
2. Verification of superposition theorem.
3. Verification of Thevenin's and Norton's theorems.
4. Series and Parallel resonance of RL and RC circuits.
5. Open circuit & Short circuit tests on a single phase transformer.
6. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
7. Speed control of DC shunt motor.
8. Torque Speed Characteristic on single phase induction motor
9. Regulation of Alternator.
10. Demonstration of Buck and Book converter

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11. Demonstration of Voltage Source Inverter
12. Demonstration of Low Voltage Switch gear.

COURSE OUTCOMES:

On completion of this course, students are

1. Able to determine the time response and resonance of given RL, RC and RLC circuits
2. Able to determine the response using Superposition, Norton and Thevinins.
3. Able to determine the power , efficiency and regulation of ac machines
4. Able to determine the speed torque characteristics of dc and induction motors
5. Able to analyze the operation of Buck and boost converter and voltage source inverter.
6. Able to analyze the operation of LV Switch gear system.

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Summary of Course Outcomes mapping to Program Outcomes

COs / POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0
3	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0
4	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0
5	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
6	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Course	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS & HUMAN RIGHTS Common to all			
Subject Code	18CMMSN1080/2080	IA Marks	30
Number of Lecture Hours/Week	3+1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
	Credits – 00		

COURSE OBJECTIVES:

The objectives of this course help the students to

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.
3. To understand human rights and its implications.

Unit -1	
Lesson: Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.	**Hours – 10**
Unit -2	
Lesson: Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India.	**Hours – 10**
Unit – 3	
Lesson: State Executives – Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th &91st Amendments.	**Hours – 10**
Unit – 4	
Lesson: Special Provision for SC & ST Special Provision for Women, Children & Backward Classes	**Hours –10**

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Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchyats and Co - Operative Societies.	
Unit – 5	
Lesson: Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility.Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.	**Hours – 10**

COURSE OUTCOMES:

On completion of the course student will

1. Have general knowledge and legal literacy and thereby to take up competitive examinations.
2. Understand state and central policies, fundamental duties.
3. Understand Electoral Process, special provisions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies, and
5. Understand Engineering ethics and responsibilities of Engineers
6. Understand Engineering Integrity & Reliability

QUESTION PAPER PATTERN:

SECTION A:

1. This section contains ten one answer questions carrying 1 mark each.
2. Two questions from each unit should present.

SECTION B:

1. This section will have 5 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.

TEXT BOOKS:

Text Books:

1. Durga Das Basu: **"Introduction to the Constitution on India",** (Students Edn.) Prentice –Hall EEE, 19th / 20th Edn.,

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2001
2. Charles E. Haries, Michael S Pritchard and Michael J. Robins **"Engineering Ethics"** Thompson Asia, 2003-08-05.

REFERENCE BOOKS:

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
2. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, **"Engineering Ethics",** Prentice –Hall of India Pvt. Ltd. New Delhi, 2004
3. Brij Kishore Sharma,**" Introduction to the Constitution of India"**, PHI Learning Pvt. Ltd., New Delhi, 2011.
4. Latest Publications of Indian Institute of Human Rights, New Delhi

Website Resources

1. www.nptel.ac.in
2. www.hnlu.ac.in
3. www.nspe.org
4. www.preservearticles.com

COURSE OUTCOMES TO PROGRAM OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	**3**	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	**3**	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	**1**	-		-	-	-	-	-	-	-
4	-	-	-	-	-	**2**	-	-	-	-	-	-	-	-	-
5						**3**									
6	-	-	-	-	-	-	-	**5**	-	-	-	-	-	-	-
Co urse	-	-	-	-	-	**3**	-	**5**	-		-	-	-	-	-

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Course Structure for

B.Tech. (Mechanical Engineering)

Semester III (Second year)

S.No	Course Code	Course Title	L	T	P	C
1	18CMMAT3010	Engineering Mathematics-III	3	1	0	4
2	18MEMET3020	Engineering Mechanics	3	1	0	4
3	18MEECT3030	Basic Electronics Engg.	3	0	0	3
4	18MEMET3040	Manufacturing Processes	3	0	0	3
5	18MEMET3050	Thermodynamics	3	0	0	3
6	18MEMET3060	Materials Engineering	3	0	0	3
7	18MEMEL3070	Manufacturing Processes Lab	0	0	3	1.5
8	18MEMEL3080	CAEDP Lab	0	0	3	1.5
					Total Credits	**23**

Semester IV (Second year)

S.No	Course Code	Course Title	L	T	P	C
1	18MEMET4010	Strength of Materials	3	0	0	3
2	18MEMET4020	Fluid Mechanics & Fluid Machines	3	0	0	3
3	18MEMET4030	Theory of Machines-I	3	0	0	3
4	18MEMET4040	Applied Thermodynamics	3	0	0	3
5	18CMMST4050	Engineering Economics & Financial Management	3	0	0	3
6	18MEMEL4060	Fluid Mechanics & Fluid Machines Lab	0	0	3	1.5
7	18MEMEL4070	Mechanics of Solids & Materials Lab	0	0	3	1.5
8	18MEMEN4080	Machine Drawing Lab				
					Total Credits	**18**

ENGINEERING MATHEMATICS – III SEMESTER - III			
Subject Code	18CMMAT3010	Internal Marks	30
Number of Lecture Hours/Week	3(L) + 1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

- To find the function of a complex variable
- To evaluate complex integration and expand functions using Taylor & Maclaurin's series
- To evaluate integrals using Residues
- To find the statistical parameters for distributions
- To test the hypothesis

Unit -1	**Hours**
Function of a complex variable Introduction –continuity –differentiability- analyticity – properties – Cauchy – riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thompson method.	**10**
Unit -2	
Integration and series expansions Complex integration: Line integral – Cauchy's integral theorem, Cauchy's in integral formula, generalized integral formula (all without proofs) Radius of convergence – expansion in Taylor's series, Maclaurin's series and Laurent series	**10**
Unit – 3	
Singularities and Residue Theorem Zeros of an analytic function, Singularity, Isolated singularity, Removable singularity, Essential singularity, pole of order m, simple pole, Residues, Residue theorem, Calculation of residues, Residue at a pole of order m**,** Evaluation of real definite integrals: Integration around the unit circle**,** Integration around semi circle, Indenting the contours having poles on the real axis.	**10**
Unit – 4	
Discrete Random variables and Distributions: Introduction-Random variables- Discrete Random variable-Distribution function- Expectation. Discrete distributions: Binomial, Poisson and Geometric distributions and their fitting to data. **Continuous Random variable and distributions:** Introduction-Continuous Random variable-Distribution function- Expectation-Continuous distribution: Uniform, Exponential and Normal distributions, Normal approximation to Binomial distribution	**10**
Unit – 5	
Test of Significance: Introduction - Population and samples- Sampling distribution of means (σ-known) t-distribution- Sampling distribution of means(σ-unknown), chi-square and F- test Hypothesis-Null and Alternative Hypothesis- Type I and Type II errors –Level of significance - One tail and two-tail tests- Tests concerning one mean and	**10**

proportion, two means- Proportions and their differences - ANOVA for one – way and two – way classified data	

Course outcomes:

On completion of this course, students are able to

1. Find the function of a complex variable
2. Evaluate complex integration and expand functions using Taylor & Maclaurin‟s series
3. Evaluate integrals using Residues
4. Find the statistical parameters for discrete distributions
5. Find the statistical parameters for continuous distributions
6. Test the hypothesis

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. B.S. Grewal, **"Higher Engineering Mathematics"**, Khanna publishers, 44th edition, 2016.
2. Erwin Kreyszig, **"Advanced Engineering Mathematics**, Wiley, 9th Edition, 2013.

Reference Books:

1. B.V. Ramana, **"Higher Engineering Mathematics"**, Tata Mc Graw-Hill, 2006
2. N.P.Bali and Manish Goyal, **"A text book of Engineering mathematics"**, Laxmi publications, 7th Edition.
3. H.K. Dass and Er. RajnishVerma, **"Higher Engineerig Mathematics"**, S.Chand publishing, 1st edition, 2011.
4. Dr. B.Rama Bhupal Reddy**, "Probability and Statistics for Engineers",** Research India Publications (DELHI), 2015.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
5	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	**2**	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-

ENGINEERING MECHANICS SEMESTER III			
Subject Code	18MEMET3020	Internal Marks	30
Number of Lecture Hours/Week	3(L)+1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			

COURSE OBJECTIVES: Students should be able to:

1. Gain knowledge on system of forces and moments
2. Describe the various types of friction
3. Draw free-body diagrams and solve statics problems
4. Acquire knowledge on centre of gravity and moment of inertia for different sections.
5. Calculate velocity and acceleration of particles having rectilinear or curvilinear motion.
6. Analyze the problems on work energy method and impulse-momentum method.

Unit -1	**Hours**
Introduction to Engg. Mechanics – Basic Concepts. **Systems of Forces:** Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems. **Friction:** Introduction, limiting friction and impending motion, Coulomb's laws of dry friction, coefficient of friction, cone of friction	**10**
Unit -2	
Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. Lamis Theorm, graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces, condition of equilibrium, analysis of plane trusses (Method of joints only)	**8**
Unit – 3	
Centroid and Centre of Gravity: Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications. **Area Moment of Inertia:** Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections.	**10**
Unit – 4	
Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Bodies – Types and their analysis in Planar Motion. **Kinetics:** Analysis of a Particle and Rigid Body in Translation– Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.	**12**
Unit-5	
Work – Energy Method: Equations for Translation, Work-Energy Application to Particle Motion, Connected System - Fixed Axis Rotation and Plane Motion, Impulse momentum method.	**10**

Course Outcomes:

On completion of this course, students will be able to

1. Determine the resultant force and moment for a given system of forces
2. Apply laws of friction to simple mechanisms with consideration of friction
3. Draw free-body diagrams and solve statics problems

4. Determine centroid and moment of inertia of simple and composite bodies
5. Calculate the motion characteristics of a body subjected to a given force system
6. Solve the problems using work energy method and impulse-momentum method.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Engineering Mechanics - S.Timoshenko & D.H.Young., 4th Edn - , Mc Graw Hill publications.
2. Engineering Mechanics-Statics and Dynamics by A Nelson, Tata McGraw Hill Education Private Ltd, New Delhi, 2009.

Reference Books:

1. Engineering Mechanics statics and dynamics – R.C.Hibbeler, 11th Edn – Pearson Publ.
2. Engineering Mechanics, statics – J.L.Meriam, 6th Edn – Wiley India Pvt Ltd.
3. Engineering Mechanics, statics and dynamics – I.H.Shames, – Pearson Publ.
4. Mechanics For Engineers, statics - F.P.Beer&E.R.Johnston – 5th Edn Mc Graw Hill Publ.
5. Mechanics For Engineers, dynamics - F.P.Beer&E.R.Johnston –5th Edn Mc Graw Hill Publ.
6. Theory & Problems of engineering mechanics, statics & dynamics – E.W.Nelson, C.L.Best& W.G. McLean, 5th Edn – Schaum's outline series - Mc Graw Hill Publ.
7. Singer's Engineering Mechanics: Statics And Dynamics, K. Vijay Kumar Reddy, J. Suresh Kumar, BS Publications
8. Engineering Mechanics, Fedinand. L. Singer, Harper – Collins.

Web Source References:

1. https://nptel.ac.in/courses/nptel_download.php?subjectid=122104015
2. http://myengineeringmechanics.com/

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	-	-	-	-	-	-	-	-	-	1	-	2
2	3	3	-	-	-	-	-	-	-	-	-	1	-	2
3	3	3	-	-	-	-	-	-	-	-	-	1	-	2
4	3	3	-	-	-	-	-	-	-	-	-	1	-	1
5	3	3	-	-	-	-	-	-	-	-	-	1	-	1
6	3	3	-	-	-	-	-	-	-	-	-	1	-	1
Course	**3**	**3**	-	-	-	-	-	-	-	-	-	**1**	-	**3**

BASIC ELECTRONICS ENGINEERING SEMESTER III			
Subject Code	18MEECT3030	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

- Understand the basics of analog electronics circuits
- Describe the basics of digital electronics.
- Discuss the concepts of electronic communications.

Unit -1	**Hours**
Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.	**12**
Unit -2	
Operational amplifier and its applications: Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.	**12**
Unit – 3	
Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.	**8**
Unit – 4	
Digital Electronics Fundamentals :Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications	**10**
Unit – 5	
Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.	**8**

Course outcomes:

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

1. Understand the basics of semiconductor devices and their applications.
2. Describe the application using Operational amplifier.
3. Discuss the working of timing circuits and oscillators.
4. Understand building block of digital systems.
5. Interpret different sequential circuits
6. Summarize the basics of Electronic communication system.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Integrated Electronics – J Millman, C. Halkies, C.D.Parikh, Tata Mc-Graw Hill, 2009.
2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd.
3. Digital Design – M Morris Mano, Third Edition, Pearson Publications.
4. Electronic Communication Systems-George Kennedy,5th Edition, Tata Mc-Graw Hill

Reference Books:

1. Electronic Devices and Circuits – K Venkata Rao ,K Rama Sudha, Tata Mc-Graw Hill.
2. Electronic Devices and Circuits - Salivahanan, Kumar, Vallavaraj, 2nd Edition, Tata Mc- Graw Hill
3. Fundamentals of Logic Design- Charles H.Roth,Jr., 5th Edition, India Edition

Web Source References

1. https://nptel.ac.in/courses/117101106/
2. https://nptel.ac.in/courses/108102095/
3. https://nptel.ac.in/courses/117106086/
4. http://www.nptelvideos.in/2012/11/communication-engineering.html

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	-	-	-	-	-	-	-	-	2	-	-
2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
4	3	3	1	-	-	-	-	-	-	-	-	2	-	-
5	3	2	2	-	-	-	-	-	-	-	-	2	-	-
6	3	1	1	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**2**	**1**	-	-	-	-	-	-	-	-	**2**	-	-

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Semiconductor Devices and Applications	T1	3,4,5 & 8
		R2	4 & 5
2	Operational amplifier and its applications	T2	2,3 & 4
		R1	14 & 15
3	Timing Circuits and Oscillators	T1	8
		T2	14
		R1	9 & 10
4	Digital Electronics Fundamentals	T3	2,3,4,5 & 6
		R3	2,3,5
5	Electronic Communication Systems	T4	1,3 & 4

MANUFACTURING PROCESSES SEMESTER III			
Subject Code	18MEMET3040	Internal Marks	30
Number of Lecture Hours/Week	03(L)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits - 03

Course Objectives:

This course will enable students to:

- Acquire the knowledge on casting process.
- Impart the knowledge on special casting processes.
- Learn the concept of on forming processes.
- Make familiars with the different welding parameters and other joining process.
- Understand the concept of advanced welding processes for various applications
- Compare the difference between injection and blow moulding.

Unit -1	**Hours**
Introduction: Introduction to manufacturing processes and classification. **Casting:** Steps involved in making a casting. Patterns and Pattern making: Types of patterns, Materials used for patterns, Pattern allowances. Moulding sand: Molding sand composition, sand properties, Sand preparation. Core: Core sands, Types of cores, Core prints, Chaplets. Principles of Gating, Gating ratio and Design of Gating systems.	**9**
Unit -2	
Melting and Solidification of casting: Cupola furnace, Steel making processes. Solidification of pure metal and alloys, Short & long freezing range alloys. Risers: Types, function and design, Casting design considerations. **Special casting processes:** Centrifugal, Die and Investment casting. Casting defects-Causes and remedies.	**9**
Unit – 3	
Welding: Introduction, classification of welding processes, types of welded joints and their characteristics. Gas welding: Different types of flames and uses, Oxy – Acetylene Gas welding. Basic principles of Arc welding, Manual metal arc welding, Sub merged arc welding, TIG & MIG welding. Resistance welding: Spot welding, Seam welding, Projection welding, Upset welding, and Flash butt welding. Special welding processes: Thermit welding, Friction welding, Electron beam welding, and Laser beam welding. Soldering and Brazing. welding defects – causes and remedies.	**12**
Unit – 4	
Metal Forming: Nature of plastic deformation, Hot and cold working. Rolling: Principle, Types of rolling mills and products, Roll passes, Forces in rolling and power requirements. Extrusion: Basic extrusion process and its characteristics, Hot extrusion and cold extrusion, Impact extrusion, Hydrostatic extrusion. Forging: Principles of forging, Tools and dies, Types: Smith forging, Drop Forging, Forging hammers, Rotary forging, forging defects. Wire drawing and tube drawing.	**10**
Unit-5	
Sheet metal forming: Blanking, Bending, Piercing, Spring back effect, Stamping, Drawing, Coining, Embossing, Stretch forming, Hot and cold	**10**

spinning. Special forming: Hydro forming, High energy rate forming.
Introduction to Powder Metallurgy – compaction and sintering, advantages and applications.
Processing of Plastics: Types of Plastics, Properties, Applications and their processing methods, Blow and Injection moulding.

Course Outcomes:

On completion of the course, student will be able to

1. Recognize the different types of casting processes.
2. Select suitable manufacturing process for typical components.
3. Describe the various welding processes.
4. Analyze the processes of forging, rolling process and extrusion.
5. Recognize advanced welding processes for different applications.
6. Explain the concepts of Powder metallurgy and plastic processing methods

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Manufacturing Technology -Vol I- P.N. Rao- TMH
2. Manufacturing processes for engineering materials- Kalpakjain. S & Steven R Schmid-Pearson publ,5thEdn
3. Workshop Technology – B.S.Raghu Vamshi – Vol I
4. Manufacturing Engineering and Technology - Kalpakjain. S & Steven R Schmid-Pearson publ,4th Edn
5. Manufacturing Science – A.Ghosh&A.K.Malik – East West Press Pvt. Ltd.

Reference Books:

1. Production Technology-P C Sharma-S. Chand
2. Production Technology by R.K. Jain and S.C. Gupta.
3. Metal cutting Principles by M.C. Shaw
4. Production Technology by H.M.T. (Hindustan Machine Tools).

Web Source References:

1. http://nptel.ac.in/courses/112107144/metalcasting/lecture15.htm
2. http://web.iitd.ac.in/pmpandey/MEL120_html/Metal%20Forming%20Processes.pdf
3. https://onlinecourses.nptel.ac.in/noc19_me16/course

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	-	-	-	-	-	-	-	-	-	-	3	-
2	2	-	-	-	1	-	-	-	-	-	-	-	3	-
3	2	-	-	-	1	-	-	-	-	-	-	-	3	-
4	2	-	-	-	-	-	1	-	-	-	-	1	2	-
5	2	-	-	-	3	-	1	-	-	-	-	1	2	-
6	2	-	-	-	3	-	1	-	-	-	-	1	2	-
Course	2	2	-	-	2	-	1	-	-	-	-	1	3	-

THERMODYNAMICS SEMESTER III			
Subject Code	18MEMET3050	Internal Marks	30
Number of Lecture Hours/Week	03(L)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

- Gain the knowledge on the fundamentals of thermodynamics and temperature scales.
- Apply First law of thermodynamics to various thermal engineering devices.
- Understand the direction of law.
- Explain the concept of increase in entropy of universe.
- Develop an idea on properties during various phases of pure substances, mixtures, usage of steam tables and Mollier chart, psychometric charts.
- Acquire the knowledge of thermodynamics to air standard cycles, vapour power cycle and the properties of gas mixtures.

Unit -1	**Hours**
Introduction: Basic Concepts Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work - Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work. Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers	**10**
Unit -2	
First Law of Thermodynamics: Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy-Demonstration as a property; Various modes of energy, Internal energy and Enthalpy. First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady, first law applications for system and control volume. Compressibility charts- Properties of two phase systems.	**10**
Unit – 3	
Second law of Thermodynamics: Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale. **Clausius inequality** : Definition of entropy ; Demonstration that entropy is a property; Evaluation of entropy for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Principle of increase of entropy; Illustration of processes in T-S coordinates; **Irreversibility and Availability**: Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume and energy balance equation.	**12**
Unit – 4	
Pure Substance: Definition of Pure substance, - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface;	**8**

Use of steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart. Determination of entrophy from steam tables	
Unit – 5	
Mixtures of Perfect Gases: Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures and Basics of compressible flow. **Thermodynamic Cycles:** Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericcson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles. Brayton and Rankine cycles – Performance Evaluation-improving methods – combined cycles, Bell-Coleman Cycle, Vapour compression cycle-performance Evaluation.	**10**

Course Outcomes:

On completion of the course, student will be able to

1. Identify type of thermodynamic systems in the energy perspective.
2. Solve the practical thermodynamic problems by applying first law and steady flow energy equation.
3. Analyze the problems on heat engines, refrigeration and entropy by applying direction of law
4. Illustrate the concept of entropy by using second law of thermodynamics.
5. Calculate the thermodynamic properties of the
6. Evaluate the performance of air standard cycles and vapor power cycle and analyze the properties of gas mixtures

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Engineering Thermodynamics, PK Nag 4th Edn , TMH.
2. Fundamentals of Thermodynamics- Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J, 2003, 6th Edition, John Wiley and Sons.

Reference Books:

1. Engineering Thermodynamics – Jones & Dugan PHI
2. Thermodynamics – An Engineering Approach with student resources DVD Y.A.Cengel&M.A.Boles , 6th Edn – McGrawHill
3. Basic Engineering Thermodynamics – A.Venkatesh – Universities press.
4. An Introduction to Thermodynamics – Y.V.C.Rao – Universities press.
5. Engineering Thermodynamics – P.Chattopadhyay – Oxford Higher Edn Publ.
6. Engineering Thermodynamics – D.P.Misra, Cengage Publ.

Web Source References:

1. https://nptel.ac.in/courses/112108148/pdf/Module_1.pdf
2. https://nptel.ac.in/courses/112108148/pdf/Module_2.pdf
3. https://nptel.ac.in/courses/112108148/pdf/Module_3.pdf
4. https://nptel.ac.in/courses/112108148/pdf/Module_4.pdf
5. https://nptel.ac.in/courses/112108148/pdf/Module_6.pdf
6. https://nptel.ac.in/courses/112108148/pdf/Module_7.pdf

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	-	1	3	-
2	3	2	-	-	-	-	-	-	-	-	-	1	3	-
3	3	2	-	-	-	-	-	-	-	-	-	1	3	-
4	2	3	-	-	-	-	-	-	-	-	-	1	3	-
5	3	3	-	-	-	-	-	-	-	-	-	1	3	-
6	3	3	-	-	-	-	-	-	-	-	-	1	3	-
Course	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**-**

MATERIALS ENGINEERING SEMESTER III			
Subject Code	18MEMET3060	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Course objectives:

This course will enable students to:

- Classify different bonds in solids and understand crystallization of the metals, for the formation of the solid solutions and compounds.
- Understand different phase diagrams .
- Recorgnize the property requirements of a given application and suggest a suitable ferrous and non ferrous metal and their alloys.
- Illustrate the property requirements of a given application and suggest appropriate heat treatment
- Identify the property requirements of a given application and suggest a suitable ceramics, composite materials
- Identify the relationships between structure, composition and properties of different engineering materials.

Unit -1	**Hours**
Structure of Metals and Constitution of alloys: Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size. Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds. Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery.	**10**
Unit -2	
Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorpous alloy systems, equilibrium cooling and heating of alloys, lever rule, coring, miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys.	**8**
Unit - 3	
Ferrous & non-ferrous metals and their alloys Structure and properties of white cast iron, malleable cast iron, grey cast iron, spheroid graphite cast iron, alloy cast irons. Classification of steels, structure and properties of plain carbon steels, low alloy steels, Hadfield manganese steels, tool and die steels. Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys	**12**
Unit – 4	
Heat treatment of Alloys: Annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface-hardening methods (carburizing, carbo-nitriding, cyaniding, induction hardening and flame hardening), age hardening treatment, and cryogenic treatment of alloys. vacuum and plasma hardening	**8**

Unit-5

Ceramic and composite materials: Crystalline ceramics, glasses, cermets, abrasive materials, nanomaterial's – definition, properties and applications of the above. Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C – C composites.	**12**

Course outcomes:

On completion of the course, student will be able to

1. Classify different bonds in solids and understand crystallization of the metals, for the formation of the solid solutions and compounds.
2. Different phase diagrams and study of binary phase diagrams
3. Recorgnize the property requirements of a given application and suggest suitable ferrous & non ferrous alloys
4. Analyze the property requirements of a given application and suggest appropriate heat treatment
5. Identified the property requirements of a given application and suggest a suitable ceramics, composite materials
6. Understand the relationships between structure, composition and properties of different engineering materials

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Introduction to Physical Metallurgy - Sidney H. Avener - McGrawHill
2. Essential of Materials science and engineering - Donald R.Askeland -Thomson

Reference Books:

1. Material Science and Metallurgy – V.D.Kodgire and S.V.Kodgire
2. Materials Science and engineering - Callister & Baalasubrahmanyam
3. Material Science for Engineering students – Fischer – Elsevier Publishers.
4. Material science and Engineering - V. Rahghavan
5. Introduction to Material Science and Engineering – Yip-Wah Chung CRC Press.
6. Material Science and Metallurgy – A V K Suryanarayana – B S Publications.
7. Material Science and Metallurgy – U. C. Jindal – Pearson Publication

Web Source References:

1. https://www.iitm.ac.in/mmresearch
2. http://nptel.ac.in/courses/113106032/3
3. https://en.wikipedia.org/wiki/Materials_science

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	1	1	-	-	-	-	-	-	2	3	-
2	2	2	1	1	1	-	-	-	-	-	-	2	3	-
3	2	2	1	1	1	-	-	-	-	-	-	2	3	-
4	2	2	1	1	1	-	-	-	-	-	-	2	3	-
5	2	2	1	1	1	-	-	-	-	-	-	2	3	-
6	2	2	1	1	1	-	-	-	-	-	-	2	3	-
Course	2	2	1	1	1	-	-	-	-	-	-	2	3	-

MANUFACTURING PROCESSES LABORATORY SEMESTER III			
Subject Code	18MEMEL3070	Internal Marks	50
Number of Lecture Hours/Week	03	External Marks	50
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 1.5			

Course objectives:

This course will enable students to:

- Determine the concepts of manufacturing process.
- Impart the design and manufacture of patterns for mould preparation.
- Make familiars with the different welding parameters and other joining process.
- Understand the practicalconcepts of TIG welding.
- impart hands-on practical exposure on metal forming processes.
- Compare the difference between injection and blow moulding.

I. METAL CASTING:

1. Preparation of a Sand mould using gear wheel pattern.
2. Preparation of a wax mould using.Split Piece Pattern
3. Preparation of a Stepped pulley pattern using wooden material.
4. Determination of Sand properties on Universal Strength Machine

II. WELDING PRACTICE:

1. Preparation of a Square Butt joint using arc welding.
2. Preparation of a Vertical joint using arc welding.
3. Preparation of a T-lap joint using Spot Welding.
4. Preparation of a Square Butt joint using TIG welding.
5. Joining of wires on circuit board using Soldering process.
6. Preparation of a lap joint using Oxy-acetylene gas welding process.

III. METAL FORMING:

1. Preparation of a washer using blanking & Piercing operations.
2. Preparation of Square tray.

IV. PROCESSING OF PLASTICS:

1. Preparation of a bottle cap using injection moulding.
2. Preparation of a bottle using blow moulding.

Course outcomes:

On completion of the course, student will be able to

1. Gain the knowledge of manufacturing process.
2. Know the design and manufacture of patterns for mould preparation.
3. Operate arc welding, gas welding and resistance welding equipment
4. Apply the practicalconcepts of TIG welding.
5. Acquire fundamental knowledge on metal forming processes.
6. Identify the difference between injection and blow moulding.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	-	-	-	-	-	-	-	-	-	-	3	-
2	2	-	-	-	2	-	-	-	-	-	-	-	3	-
3	2	-	-	-	2	-	-	-	-	-	-	-	3	-
4	2	-	-	-	-	-	2	-	-	-	-	2	2	-
5	2	-	-	-	3	-	2	-	-	-	-	2	2	-
6	2	-	-	-	3	-	2	-	-	-	-	2	2	-
Course	2	-	-	-	2	-	1	-	-	-	-	1	3	-

COMPUTER AIDED ENGINEERING DRAWING PRACTICE LAB (CAEDP) SEMESTER III			
Subject Code	18MEMEL3080	Internal Marks	50
Number of Lecture Hours/Week	04	External Marks	50
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 1.5			

Course Objectives:

This course will enable students to:

- Gain knowledge on orthographic projections of solids inclined to both the planes and interpenetrations of solids.
- Identify and gain knowledge how to prepare a surface development of solids
- Identify various commands used in Auto CAD Screen to create 2D and 3D models
- Create 2D models by using various toolbars
- Reproduce solid models of various machine parts by using 3D modeling toolbars

Part-A	**Hours**
Unit -1	
Projections & Interpenetration of Solids **Projections of solids**: Projections of Regular Solids inclined to both planes. **Interpenetration of right regular solids:** Intersection of Cylinder Vs Cylinder, Prism Vs Prism.	**8**
Unit -2	
Development of Solids: Development of Surfaces of Right Regular Solids – Prisms, Cylinder, Pyramid , Cone.	**6**
Part-B	
Unit –3	
Review of Computer Aided Drafting: Introduction, history of CAD, advantages of CAD, auto CAD screen components, starting a new drawing, opening an existing drawing, setting drawing limits, saving a drawing file, exiting an autoCAD session, dynamic input/command prompt, coordinate system, choosing commands in autocad, object snaps. **Advanced Sketching**: Arcs, rectangles, ellipses, regular polygon, polylines, placing points, infinite lines commands, writing a single line text, Object Properties and excercises.	**12**
Unit –4	
Editing Sketched Objects and Dimensioning: Editing, moving, copying, offsetting, rotating, scaling, filleting, chamfering, trimming, extending, stretching of sketched objects, rectangular array,polar array path array, mirroring the sketched objects and text mirroring, creating text and tables, fundamental dimensioning terms and linear and angular dimensioning and excercises	**12**
Unit – 5	
Computer Aided Solid Modelling: Introduction to the 3D Modeling Workspace, Basic 3D Viewing Tools, 3D Navigation Tools, User Coordinate System, Solid Primitive Types**.** **Creating Solids & Surfaces from 2D Objects** :Extruded , Swept, Revolved,	**12**

and Lofted Solids and Surfaces, Advanced Solid Editing, Creating Multiple Viewports, Modeling of simple solids, Modeling of machine parts and exercises'

Course Outcomes:

On completion of the course, student will be able to

1. Draw orthographic projections of solids inclined to both the planes and interpenetrations of solids.
2. Prepare a surface development of solids
3. Identify the commands in sketching
4. Describe various editing and dimensioning commands used drafting software
5. Create 2D models by using various toolbars
6. Reproduce solid models of various machine parts by using 3D modeling toolbars

Internal Assessment Pattern

Date to Date Work	:10 M
Mid Examination-I	:10 M
Computer Aided drafting Date to Date Work	:20 M
Internal Examination-	:10 M
Total Internal Assessment Marks	**: 50 M**

Question paper pattern:

Section A:

1. This section contains two question carrying 10 mark each.
2. Two questions from each unit of part-A

Section B:

1. This Section will have 10 experiments from Part-B.
2. Each Experiments carries 30 marks.
3. The student will have to answer any one questions from 10 Questions.

Text Books:

1. AutoCAD for Engineering Drawing Made Easy by P. Nageswara Rao; Tata McGraw Hill, New Delhi.
2. Auto CAD 2014 for Engineers and Designers by Tickoo Sham, Dream Tech.

References Books:

1. Mastering Auto CAD 2013 and Auto CAD LT2013 – George Omura, Sybex
2. Engineering Drawing – KL Narayana, P Kannaiah, Scitech
3. Engineering Drawing – RK Dhawan, S Chand
4. Engineering drawing by N.D Bhatt, Charotar publications.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	2	2	-	-	-	-	-	-	3	-	3
2	2	2	3	2	2	-	-	-	-	-	-	3	-	3
3	2	2	3	2	2	-	-	-	-	-	-	3	-	3
4	2	2	3	2	2	-	-	-	-	-	-	3	-	3
5	2	2	3	2	2	-	-	-	-	-	-	3	-	3
Course	**2**	**2**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**

STRENGTH OF MATERIALS SEMESTER - IV			
Subject Code	18MEMET4010	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES:

This course will enable students to:

- Understand the Mechanical properties of materials, stresses, strains and their relations
- Draw the shear force and bending moment diagrams of beams under different loads.
- Analyze the shear stress distribution in solid and hollow members under transverse loading conditions.
- Calculate the slope and deflection at a specified point of a beam under different loads.
- Acquire the knowledge of stresses in thick and thin cylinders
- Distinguish the columns and struts

UNIT -1	**Hours**
Introduction: Stress and Strain definitions, types of stresses and strains, elasticity and plasticity. Hooke's law, stress-strain diagrams for engineering materials, modulus of elasticity. Poisson's ratio, relationship between elastic constants, linear and volumetric strains, bars of uniform strength, temperature stresses, compound bars.	**9**
Unit -2	
Beams: Definition of bending moment and shear force; relationship between intensity of loading, shear force and bending moment; bending moment and shear force diagrams for cantilever, simply supported and overhanging beams; simple theory of bending, moment of resistance, modulus of section.	**10**
Unit – 3	
Shear Stresses in Beams: Distribution of shear stresses in rectangular, I-section and T-section for solid and hollow sections. Compound stresses, principal stresses and strains. Mohr's circle of stress.	**8**
Unit – 4	
Slopes and Deflections: Slope and deflection measurements of cantilever, simply supported beams with Macaulay's and double integration methods subjected to point loads and uniformly distributed loads. Torsion: Derivation of torsion formula for circular sections, torsional stresses, angle of twist, power transmission, effect of combined bending and torsion	**13**
Unit – 5	
Cylinders: Stresses in thin and thick cylinders with internal and external pressures. Hoop and longitudinal stresses in cylinders, stresses in compound cylinders. **Columns and Struts:** Euler's and Rankine's formulae for axial load applications. Secant and Perry formulae for eccentrically loaded columns.	**10**

Course Outcomes:

On completion of the course, student will be able to

1. Calculate stresses and strains in a member subjected to different loadings.
2. Construct shear force and bending moment diagrams for beams subjected to

different loads
3. Compute bending stress and shear stresses of a beam
4. Estimate the deflections of different beams under various loads
5. Calculate the stresses in thick and thin cylindrical and spherical shells under different loads and directions
6. Distinguish the types columns and struts.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Bhavikatti. S. S., Strength of Materials, Vikas Publishing House (P) Ltd., New Delhi, Second Edition, 2002.
2. R.K.Rajput, Strength of materials, S.Chand& Co revised edition, New Delhi-2007

Reference Books:

1. Punmia. B. C., Jain, A. K., and Jain, A. K., Strength of Materials and Theory of Structures, Vols. I & II, XI Edition, Laxmi Publications (P) Ltd, New Delhi, 2002.
2. Hearn, E. J., Strength of Materials, Pergamon Press, Oxford, 1997.
3. R.K.Bansal, Introduction to text book of Strength of materials, Laxmi publications 2004.
4. U.C. Jindal Introduction to text book of Strength of Material Galgotia publications. Second Edition 2001
5. Beer and Johnston, Mechanics of Materials, McGraw Hill, 4th Edition, 2005.
6. Gere and Timoshenko, Mechanics of Materials, PWS Publishing Company, 4th Edition, 1997.
7. S.B.Junarkar and H.J. Shah, Mechanics of Structures, 27th Revised and Enlarged, Charotar Publishing House, 2008.

Web Source References:

1. https://nptel.ac.in/courses/112107146/1
2. https://onlinecourses.nptel.ac.in/noc17_ce17
3. https://nptel.ac.in/courses/105105108/1
4. https://onlinecourses.nptel.ac.in/noc18_ce04/course

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	-	-		1	-	-	-	-	-	3	-	1
2	2	2	-	1	-	-	-	-	-	-	-	3	-	1
3	2	2	1	1	-	-	-	-	-	-	-	3	-	1
4	-	2	-	-	1	1	-	-	-	-	-	3	-	1
5	-	2	-	-	1	1	-	-	-	-	-	3	-	1
6	-	2	1	-	-	-	-	-	-	-	-	3	-	1
Course	**2**	**2**	**1**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**1**

FLUID MECHANICS AND FLUID MACHINES SEMESTER IV			
Subject Code	18MEMET4020	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Course Objectives:

This course will enable students to:

- Understand the fundamental properties of fluid and calculate fluid pressure using the manometer.
- Apply the differential conservation equations of mass, momentum, and energy to fluid flow problems.
- Evaluate major and minor losses in pipes and also discuss boundary layer concept.
- Solve problems on the turbo machinery using analytical method and velocity triangles.
- Classify the different types of turbines & evaluate work done and efficiency.
- Discuss the Classification and working principles of pumps and evaluate the performance of hydraulic machines.

Unit -1	**Hours**
Fluids: Definition of fluid, Fluid properties, Atmospheric gauge and vacuum pressure – measurement of pressure. Manometers- Piezometer, U-tube, inverted and differential manometers. Pascal's law, hydrostatic law. Buoyancy, forces on submerged bodies, stability of floating bodies.	**8**
Unit -2	
Fluid Kinematics: Introduction, flow types. Equation of continuity for one dimensional flow. Stream line, path line and streak lines and stream tube. Stream function and velocity potential function. **Fluid Dynamics:** surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.	**10**
Unit – 3	
Closed Conduit Flow: Reynold's experiment- Darcy Weisbach equation, Minor losses in pipes- pipes in series and pipes in parallel- total energy line hydraulic gradient line. **Boundary Layer Theory:** Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer.	**8**
Unit – 4	
Basics of Turbo Machinery: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes. **Hydraulic Turbines:** classification of turbines, Working and efficiencies of Pelton wheel, Francis and Kaplan turbines. Importance of Draft Tube.	**12**
Unit-5	
Hydraulic Quantities: Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. **Centrifugal Pumps:** Classification, working, work done – manometric head losses and efficiencies- specific speed- pumps in series and parallel performance	**12**

characteristic curves, cavitation & NPSH.
Reciprocating Pumps: Working, Discharge, slip, indicator diagrams.

Course outcomes: Students will be able to:

1. Remember the various properties of fluids and pressure measurement devices.
2. Understand the kinematics and dynamics of fluids in detail.
3. Estimate the losses in pipes and understand the concept of Boundary layer theory
4. Solve problems on the turbo machinery using analytical method and velocity triangles.
5. Analyze the performance of hydraulic turbines, unit and specific quantities
6. Analyze the working of hydraulic pumps and their performance curves

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Hydraulics and fluid mechanics including hydraulic machines by Dr. P.N. Modi & Dr. S.M. Seth, Rajsons publications private Ltd.
2. A Text Book of Fluid Mechanics by R.K. Rajput, S. Chand publishers
3. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Revised 9th edition LP Publishers
4. Hydraulics, fluid mechanics and Hydraulic machines by R.S. Khurmi, S. Chand publishers

Reference Books:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria& Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga& Sharma, Khanna Publishers.
4. Instrumentation for Engineering Measurements by James W. Dally, William E. Riley, John Wiley & Sons Inc. 2004 (Chapter 12 – Fluid Flow Measurements).

Web Source References:

1. https://nptel.ac.in/courses/112104118/3
2. https://freevideolectures.com/course/3246/fluid-mechanics-iii
3. https://freevideolectures.com/course/89/fluid-mechanics

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	2	-	-	-	-	-	-	-	-	3	2	-
2	3	1	-	-	-	-	-	-	-	-	-	2	2	-
3	3	1	-	-	-	-	-	-	-	-	-	2	2	-
4	2	2	3	-	-	-	-	-	-	-	-	2	2	-
5	2	1	3	-	-	-	-	-	-	-	-	3	2	-
6	2	1	3	-	-	-	-	-	-	-	-	3	2	-
Course	2	1	2	-	-	-	-	-	-	-	-	3	2	-

THEORY OF MACHINES – I SEMESTER IV			
Subject Code	18MEMET4030	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course objectives:

This course will enable students to:

- Understand the basic terms used in mechanisms and inversions of different mechanisms
- Acquire knowledge on straight line motion mechanisms and other lower pairs.
- Calculate the velocity and acceleration of any point/link in a mechanism
- Understand types of cam mechanisms
- Draw the cam profile for different follower motions and to design cam mechanisms for specified output motions.
- Learn basic concepts of gears and gear trains

Unit -1	**Hours**
Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained . Grublers criterion , Grashoff's law , Degrees of freedom, Kutzbach criterion for planar mechanisms, Mechanism and machines – classification of machines – kinematic chain – inversion of mechanism – inversion of mechanism – inversions of quadric cycle, chain – single and double slider crank chains	**10**
Unit -2	
Lower Pair Mechanism : Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russel – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, Pantograph. Conditions for correct steering – Davis Steering gear, Ackermans steering gear – velocity ratio; Hooke's Joint: Single and double – Universal coupling–application–problems. – Mechanical advantage, Ratchets and Escapements	**09**
Unit – 3	
Plane Motion of Body: Instantaneous centre of rotation, centrode and axode – Procedure for locating instantaneous centres, relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of velocity of points and angular velocity of links. **Kinematics**: Velocity and acceleration – Motion of a link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method four bar mechanism. Velocity and acceleration analysis for a given mechanism, Klein's construction, determination of Coriolis component of acceleration.	**12**
Unit – 4	
Cams and Followers: Definitions of cam and followers – their uses – Types of followers and cams – Terminology –Types of follower motion: Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return	**09**

strokes in the above 3 cases. Analysis of motion of followers: Roller follower – circular arc cam with straight, concave and convex flanks	
Unit-5	
Gears: Introduction, Higher pairs, friction wheels and toothed gears.Spur Gear Terminology and definitions –Gear tooth action – path of contact, arc of contact ,contact ratio. Law of toothed gearing – Involutes and cycloidal tooth profiles — Interference and undercutting, condition for minimum number of teeth to avoid interference – gear teeth – Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. **Gear trains** –types, Speed ratio, train value – Parallel axis gear trains– Epicyclic Gear Trains – Differentials	**10**

Course outcomes:

On completion of the course, student will be able to

1. Explain the importance of kinematics, kinematic pairs and mechanisms
2. Describe the relative motion between the parts of a mechanism without considering the forces.
3. Summarize various mechanisms for straight line motion and steering gear, Hooke's joint with applications.
4. Analyse the velocity and acceleration concepts for four bar mechanism & slider crank mechanism using graphical method
5. Distinguish types of cam mechanisms and draw the cam profile for different follower motions
6. Calculate length of contact, arc of contact and minimum number of teeth to avoid interference. Also calculate speeds of different gears in a gear train.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Mechanism and Machine Theory by Ashok G. Ambekar, PHI Publishers
2. Theory of Machines – S. S Rattan- TMH
3. Theory of machines and Mechanisms – J.J Uicker, G.R.Pennock & J.E.Shigley - Oxford publishers.

Reference Books:

1. R L Norton, Kinematics and Dynamics of Machinery, 1st ed., Tata McGraw Hill Education Private Limited, Delhi,
2. Theory of Machines Sadhu Singh, PearsonsEdn
3. Theory of Machines by Thomas Bevan/ Oxford Universiy Press
4. Theory of Mechanisms and machines – A.Ghosh&A.K.Malik – East West Press Pvt. Ltd

Web Source References:

1. https://nptel.ac.in/courses/Webcourse-contents/IIT-Delhi/Kinematics%20of%20Machine/site/basickinematics/basickinematics08.htm

2. https://nptel.ac.in/courses/112105236/21
3. https://nptel.ac.in/courses/112105236/34
4. https://nptel.ac.in/courses/112104121/
5. https://nptel.ac.in/courses/112106137/pdf/2_1.pdf

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	-	-	-	-	-	-	-	-	-	-	-	-
2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
4	2	1	2	-	-	-	-	-	-	-	-	2	-	-
5	1	2	2	-	-	-	-	-	-	-	-	2	-	-
6	1	2	2	-	-	-	-	-	-	-	-	-	-	-
Course	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

APPLIED THERMODYNAMICS SEMESTER IV			
Subject Code	18MEMET4040	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES:

This course will enable students to:

- Understand the concept of combustion of fuels and the concepts of psychrometry
- Knowledgeable in steam power plants and their components, performance and analysis of steam turbines.
- Gain the knowledge of steam nozzles and their performances in industries.
- Sketch the velocity diagrams of single and multi-stage steam turbines.
- Categorize the different gas turbine arrangements, their advantages and disadvantages and different applications
- Classify various types of air compressors and their working principles.

Unit -1	**Hours**
Basic Concepts: Introduction to solid, liquid and gaseous fuels– Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations using free energy. Properties of dry and wet air, use of psychrometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.	**10**
Unit -2	
Vapour Power Cycles: Rankine cycles – Performance Evaluation-improving methods **Boilers :** Classification – working principles of L.P & H.P boilers with sketches, mountings and accessories – working principles, boiler horse power, equivalent evaporation, efficiency and heat balance – draught, classification – height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced.	**12**
Unit – 3	
Steam Nozzles: Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis – assumptions -velocity of fluid at nozzle exit- Ideal and actual expansion in a nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line.	**8**
Unit – 4	
Steam Turbines: Classification, impulse turbine; mechanical details , velocity diagram, effect of friction Reaction Turbine: Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction – velocity diagram-Analysis of steam turbines, velocity and pressure compounding of steam turbines	**10**
Unit – 5 **Gas Turbines:** Gas power cycles, Brayton cycle, effect of reheat, regeneration and intercooling- Combined gas and vapor power cycles **Compressors:** Reciprocating compressors, staging of reciprocating	**10**

compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors	

Course Outcomes:

On completion of the course, student will be able to

1. Calculate stoichiometric air fuel ratio, excess air and the properties of psychrometry.
2. Determine the methods of improving rankine cycle efficiency and design the constructional features of various types of boilers.
3. Evaluate critical pressure and other properties of steam in a steam nozzle.
4. Compute the efficiency of steam turbines through graphical and analytical methods.
5. Analyze, compare simple and modified Brayton cycles.
6. Estimate the performance of different types of compressors.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Fundamentals of Thermodynamics, Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, , John Wiley and Sons.
2. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.

Reference Books:

1. Heat Engineering – V.P Vasandani and D.S Kumar- Metropolitan Book Company, New Delhi
2. Thermodynamics and Heat Engines, Volume 2 - R.Yadav- Central book depot.
3. Engineering Thermodynamics, PK Nag 4th Edn , TMH.
4. Thermal Engineering – S. Domkundwar – 5th Edn – Dhanpat Rai publ.
5. Thermal Engineering-P.L.Bellaney/ Khanna publishers
6. Thermal Engineering- M.L.Mathur-Jain publ.

Web Source References:

1. https://nptel.ac.in/courses/112106133/
2. http://www.edurite.com/kbase/animation-of-thermal-power-plant
3. https://www.brighthubengineering.com/power-plants/25423-how-does-a-gas-turbine-power-plant-work-the-main-equipment/
4. https://www.brighthubengineering.com/power-plants/18336-combined-cycle-power-plants-the-basics/

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	-	-	-	1	1	-	-	-	-	1	1	-
2	2	3	3	-	-	-	-	-	-	-	-	1	3	-
3	2	3	-	-	-	-	-	-	-	-	-	-	2	-
4	2	3	3	-	-	-	-	-	-	-	-	1	3	-
5	2	2	3	-	1	-	-	-	-	-	-	1	3	-
6	2	2	3	-	-	-	-	-	-	-	-	1	3	-
Course	**2**	**3**	**3**	**-**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**3**	**-**

ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT SEMESTER IV			
Subject Code	18CMMST4050	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course objectives:

This course will enable the students to

- Understand the concept and nature of Managerial Economics and Concept of Demand and Demand forecasting.
- Analyse the Cost Concepts, Cost-Volume-Profit Analysis and Market structures.
- Learn different Accounting Systems, preparation of Financial Statements and Capital Budgeting proposals by using different methods.

Unit -I	**Hours**
Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Concept of Demand-Types-Determents-Law of Demand its Exception-Elasticity of Demand-Types and Measurement- Demand forecasting and its Methods.	**10**
Unit –II	
Production and Cost Analysis: Production function-Isoquants and Isocost-Law of Variable proportions- Cobb-Douglas Production function-Economics of Sale-Cost Concepts- Opportunity Cost-Fixed vs Variable Costs-Explicit Costs vs Implicit Costs- Cost Volume Profit analysis- Determination of Break-Even Point (Simple Problems).	**10**
Unit-III	
Introduction To Markets, Pricing Policies & forms Organizations and Business Cycles: Market Structures: Perfect Competition, Monopoly and Monopolistic and Oligopoly – Features – Price Output Determination – Methods of Pricing: Market Skimming Pricing, And Internet Pricing: Flat Rate Pricing. Features and Evaluation of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises and their forms – Business Cycles – Meaning and Features – Phases of Business Cycle	**12**
Unit –IV	
Introduction to Accounting & Financing Analysis: Introduction to Double Entry Systems – Preparation of Financial Statements- Analysis and Interpretation of Financial Statements-Ratio Analysis (Simple Problems)	**10**
Unit-V	
Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods.	**08**

Course outcomes:

On completion of the course student will be able to:

1. Equipped with the knowledge of managerial economics and estimating demand for a product.
2. Examine the Production Concept and familiar with the concepts of iso-quants, iso-cost lines and MRTS
3. Predict the cost of production and its relevance to managerial decision making
4. Differentiate various the Markets and Pricing methods along with Business Cycles.

5. Prepare Financial Statements along with Analysis
6. Analyse and interpret various investment project proposals with the help of Capital Budgeting techniques.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011.
2. Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House 2011.

Reference Books:

1. Dr. P. Vijaya Kumar & Dr. N. Apparao Management Science Cengage, Delhi, 2012.
2. S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012
3. Vanitha Agarwal : Managerial Economics, Pearson Publications 2011.

Web References:

1. https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_MEFA_LECTURE_NOTES_1.pdf
2. https://www.edx.org/course/introduction-to-managerial-economics

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
Course	-	-	-	-	-	1	1	-	-	-	3	-	-	-	-

S.No.	Unit Name	Text Book / Reference	Chapter No.
1	Introduction to Managerial Economics and demand Analysis	T1	1,2,3 & 4
		T2	1,2,3 & 4
2	Production and Cost Analysis	T1	4,5,6 & 7
		T2	5,6,7,8 & 9
3	Introduction To Markets, Pricing Policies & forms Organizations and Business Cycles	T1	8 & 9
		T2	10,11,12,13 & 14
4	Introduction to Accounting & Financing Analysis	T1	13 & 14
		T2	16 &17
5	Capital and Capital Budgeting	T1	11&12
		T2	18

FLUID MECHANICS & FLUID MACHINES LAB SEMESTER IV			
Subject Code	18MEMEL4060	Internal Marks	50
Number of Practice Hours/Week	03	External Marks	50
Total Number of Practice Hours	48	Exam Hours	03
Credits – 1.5			

Course Objectives:

This course will enable students to:

- Calculate different parameters such as coefficient of discharge, coefficient of impact, power, efficiency etc. of various experiments.
- Estimate pressure variation in a flowing fluid using Bernoulli's principle applications such as Venturi meter, Orifice meter.
- Compute the head losses in various diameter pipes.
- Analyze the working of hydraulic turbines and their performance curves
- Estimate the working of hydraulic pumps and their performance curves

i. Lectures & videos related to laboratory: (07 hours)

1. Measurement of various fluid properties **(1 lecture)**
2. Flow of fluids in closed channels **(1 lecture)**
3. Flow of fluids in open channels **(1 lecture)**
4. Working of hydraulic turbines **(2 lecture)**
5. Working of hydraulic pumps **(2 lectures)**

ii. Laboratory Practice:

1. Determination of coefficient of discharge of Venture meter
2. Determination of coefficient of discharge of Orifice meter
3. Determination of coefficient of discharge of a pipe line using Turbine flow meter
4. Determination of coefficient of discharge through an open channel using V – notch apparatus
5. Verification of Bernoulli's equation
6. Determination of Friction factor of a pipe
7. Determination of coefficient of impact of a jet striking a flat vane
8. Conduct performance test on Pelton Wheel
9. Conduct performance test on Francis turbine
10. Conduct performance test on single stage Centrifugal Pump
11. Conduct performance test on Reciprocating Pump

Course Outcomes:

On completion of the course, student will be able to

1. Calculate the coefficient of discharge of various fluids
2. Evaluate the flow of fluids in closed channels
3. Solve the flow of fluids in open channels
4. Test the impact of jet on vanes
5. Analyze the working of hydraulic turbines and their performance curves
6. Estimate the performance of hydraulic pumps

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	-	-	-	-	-	-	-	-	3	2	-
2	2	1	1	-	-	-	-	-	-	-	-	2	2	-
3	2	1	1	-	-	-	-	-	-	-	-	2	2	-
4	2	2	3	-	-	-	-	-	-	-	-	2	2	-
5	2	2	3	-	-	-	-	-	-	-	-	3	2	-
6	2	2	1	-	-	-	-	-	-	-	-	2	2	-
Course	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

MECHANICS OF SOLIDS & MATERIALS LAB SEMESTER IV			
Subject Code	18MEMEL4070	Internal Marks	50
Number of Lecture Hours/Week	03	External Marks	50
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 1.5			

Course objectives:

This course will enable students to:

- Understand the mechanical properties of various materials.
- Identify the failures of brittle and ductile materials
- Find the deflection of different types of beams
- Determine modulus of rigidity of a specimen by torsion test
- Suggest a suitable ferrous and non-ferrous metal and their alloys for a given application
- Illustrate the property requirements of a given application and suggest appropriate heat treatment (annealing, normalizing, hardening etc.)
- Relate the hardenability of steels by jominy end quench test with jominy distances

List of Experiments

Part-A

1. Direct Tension test
2. Young's Modulus of metal specimen by direct Tension test
3. Brinnel's and Rock well hardness test
4. Compression test
5. Impact test
6. Test on helical Spring to determine the rigidity modulus
7. Torsion Test to determine the rigidity modulus of a shaft
8. Deflection test on a simple or cantilever beam to determine the Young's modulus

Part-B

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of mild steels, low carbon steels, high – C steels.
3. Study of the micro structures of cast Irons.
4. Study of the micro structures of non-ferrous alloys.
5. Study of the micro structures of heat treated steels.
6. Hardeneability of steels by Jominy end quench test.
7. To find out the hardness of various treated and untreated steels.

Course Outcomes:

1. Compute the strength of members of various materials under different loads such as compressive, tensile, flexural and torsional.
2. Compute the elastic property of the beammaterial by measuring deflection
3. Determine the hardness of different types of materials
4. Measure the stiffness of a spring
5. Determine themodulus of rigidity of a shaft
6. Identify a suitable ferrous and non- ferrous metal and their alloysfor a given application
7. Suggest appropriate heat treatment (annealing, normalizing, hardening, etc.) For a given application
8. Relate the hardenability of steels by jominy end quench test with jominy Distances

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	-	-	-	-	-	-	-	-	-	-	3	-
2	2	-	-	-	1	-	-	-	-	-	-	-	3	-
3	2	-	-	-	1	-	-	-	-	-	-	-	3	-
4	2	-	-	-	-	-	1	-	-	-	-	1	3	-
5	2	-	-	-	3	-	1	-	-	-	-	1	3	-
6	2	2	1	1	-	-	-	-	-	-	-	-	3	-
7	2	2	1	1	-	-	-	-	-	-	-	-	-	-
8	2	2	1	1	-	-	-	-	-	-	-	-	-	-
Course	2	2	1	1	2	-	1	-	-	-	-	1	**3**	-

MACHINE DRAWING LAB SEMESTER IV			
Subject Code	18MEMEN4080	Internal Marks	50
Number of Lecture Hours/Week	03	External Marks	50
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 00			

COURSE OBJECTIVES:

This course will enable students to:

- Study the conventions and rules to be followed by engineers for making accurate drawings.
- Understand and apply national and international standards while drawing machine component.
- Acquire knowledge of fastening arrangements such as riveting.
- Familiarize in drawing assembly, orthographic and sectional views of various joints.
- Familiarize in drawing assembly, orthographic and sectional views of various couplings.

Unit -1	**Hours**
Drawing of Machine Elements and simple parts Selection of views, additional views for the following machine elements and parts. a) Popular forms of screw threads, bolts, nuts and foundation bolts b) Keys, cotter joints and knuckle joint. c) Riveted joints for plates d) Shaft coupling, spigot and socket pipe joint. e) Journal, pivot and collar and foot step bearings.	**10**
Unit -2	
Assembly Drawing - I Drawings of assembled views for the part drawings of the following using conventions. a) Engine parts – petrol engine connecting rod, piston assembly b) Machine parts - screws jack, machine vices	**10**
Unit – 3	
Assembly Drawing - II Drawings of assembled views for the part drawings of the following using conventions. a) Machine parts - Plummer block, Tailstock. b) Valves: spring loaded safety valve, air cock	**10**
Unit – 4	
Part Drawing - I Drawings of part views of the following using conventions. Socket and spigot joint, knuckle joint, Oldham coupling.	**10**
Unit – 5	
Part Drawing - II Drawings of part views of the following using conventions. Protected flanged coupling, Bushed-pin type flanged coupling, universal coupling.	**10**

COURSE OUTCOMES:

On completion of the course, student will be able to

1. Identify the national and international standards pertaining to machine drawing.
2. Illustrate various machine components through drawings.
3. Construct an assembly drawing of a machine unit
4. Interpret a set of working drawings of a machine assembly including detail drawings, bill of materials, part specifications
5. Analyze the part or assembly drawings as per the conventions.
6. Understanding the importance of the linking functional and visualization aspects in the preparation of the part drawings

Question paper pattern :

Section A:

1. This section contains three questions carrying 10 marks each.
2. Answer any Two questions in Section- A 10x2 = 20 marks.

Section B:

1. Question from Section-B is compulsory - 50x1= 50 marks

Text Books:

1. Machine Drawing – N.Siddeswar, K.Kannaiah & V.V.S.Sastry – TMH
2. Machine Drawing –K.L.Narayana, P.Kannaiah & K. Venkata Reddy / New Age/ Publishers

Reference Books:

1. Production and Drawing – K.L. Narayana & P. Kannaiah/ New Age
2. Machine Drawing – P.S.Gill
3. Machine Drawing – N.D. Junnarkar, Pearson
4. Machine Drawing – Ajeeth Singh, McGraw Hill

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	-	3	-	-	-	-	-	-	3	-	3	3	-
2	2	-	3	-	-	-	-	-	-	3	-	3	3	-
3	2	-	3	-	-	-	-	-	-	3	-	3	3	-
4	2	-	3	-	-	-	-	-	-	3	-	3	3	-
5	2	-	3	-	-	-	-	-	-	3	-	3	3	-
6	2	-	3	-	-	-	-	-	-	3	-	3	3	-
Course	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**-**

Course Structure for

B.Tech. (Mechanical Engineering)

Semester V (Third year)

S.No	Course Code	Course Title	L	T	P	C
1	18CMBIT5010	Biology for Engineers	2	1	0	3
2	18MEMET5020	Manufacturing Technology	3	0	0	3
3	18MEMET5030	Design of Machine Elements	3	0	0	3
4	18MEMET5040	Heat Transfer	3	0	0	3
5	18MEXXO505X	Open Elective-I	3	0	0	3
6	18MEMEL5060	Heat Transfer Lab	0	0	3	1.5
7	18MEMEL5070	Manufacturing Technology & Metrology Lab	0	0	4	2
8	18MEMEC5080	Term Paper with Seminar	0	0	4	2
					Total Credits	**20.5**

Semester VI (Third year)

S.No	Course Code	Course Title	L	T	P	C
1	18MEMET6010	Theory of Machines-II	3	0	0	3
2	18CMEGT6020	Personality Development & Professional Communication	2	0	0	2
3	18MEMEP603X	Elective-I	3	0	0	3
4	18MEMEP604X	Elective-II	3	0	0	3
5	18MEXXO605X	Open Elective-II	3	0	0	3
6	18MEMEL6060	Theory of Machines Lab	0	0	3	1.5
7	18MEMEL6070	Thermal Engineering Lab	0	0	3	1.5
8	18MEMEL6080	Modelling & Simulation Lab	0	0	4	2
9	18MEMEN6090	Design of Transmission Systems				
					Total Credits	**19**

BIOLOGY FOR ENGINEERS SEMESTER - V			
Subject Code	18CMBIT5010	Internal Marks	30
Number of Lecture Hours/Week	2+1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

- convey that Biology is as important as scientific discipline as Mathematics, Physics and Chemistry
- convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.
- To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"
- convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine
- convey that without catalysis life would not have existed on earth
- molecular basis of coding and decoding genetic information is universal
- analyses biological processes at the reductionist level
- fundamental principles of energy transactions are the same in physical and biological world.

Unit -1 Introduction	**Hours**
Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology. How biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor.	**8**
Unit -2 Classification	
Hierarchy of life forms at phenomenological level- classification based on (a) cellularity- Unicellular or multicellular (b) ultra structure- prokaryotes or eucaryotes. (c) energy and Carbon utilization - Autotrophs, heterotrophy, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureoteli (e) Habitata - acquatic or terrestrial (f) Molecular taxonomy- three major kingdoms of life. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. Musculus	**8**
Unit – 3 Genetics & Biomolecules	
Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. **Molecules of life:** Monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	**12**

Unit – 4 Enzymes&Proteins	
Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions - Enzyme classification. Mechanism of enzyme action. - examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis. **Proteins**- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements. **Information Transfer:** The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosides. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination	**12**
Unit – 5 Microbiology&Metabolism	
Thermodynamics as applied to biological systems - Exothermic and endothermic versus undergone and exergoinc reactions. Concept of K_{eq} and its relation to standard free energy - Spontaneity - ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge **Concept of single celled organisms**. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics	**10**

Course outcomes:

On completion of this course, students are able to

1. Describe how biological observations of 18th Century that lead to major discoveries.
2. Convey that classification per se is not what biology is all about but highlight theunderlying criteria, such as morphological, biochemical and ecological
3. Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
4. Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
5. Classify enzymes and distinguish between different mechanisms of enzyme action.
6. To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"

(Note: Detailed Syllabus will be finalized after disusing with the Subject experts)

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
3. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

References:

1. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
2. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	3	2	-	-	-	-	-	1	-
2	-	-	-	-	-	2	3	-	-	-	-	-	2	-
3	1	-	-	-	-	3	-	-	-	-	-	-	1	-
4	3	-	-	-	-	-	2	-	-	-	-	-	1	-
5	2	-	-	-	-	3	-	-	-	-	-	-	1	-
6	3	-	-	-	-	3	3	-	-	-	-	-	1	-
Course	**1**	**-**	**-**	**-**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

MANUFACTURING TECHNOLOGY
SEMESTER V

Subject Code	18MEMET5020	Internal Marks	30
Number of Lecture Hours/Week	3(L)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits - 03

Course objectives:

This course will enable students to:

- Acquire the knowledge of theory of metal cutting and mechanisms of machining
- Understand the various machining processes
- Apply the fundamentals and principles of metal cutting to practical applications
- using lathe, shaper, slotter, planner, drilling, grinding and CNC machines
- Gain fundamental knowledge on tool materials and cutting fluids
- Learn the concepts of limits, fits and tolerances
- Know principles of metrology and measurements

Unit -1	**Hours**
Metal Cutting : Elements of metal cutting process, geometry of single point cutting tool, tool signature, chip formation and types of chips, chip breakers, mechanics of orthogonal cutting – Merchant's force diagram, cutting forces, cutting speeds, feed, depth of cut, tool life, coolants, tool materials. **Jigs & Fixtures :** Principles of design of jigs and fixtures, principles of location and clamping, applications.	**8**
Unit -2	
Lathe Machines : Engine lathe – principle of working, specification of lathe, types of lathes, construction of engine lathe, work holders & tool holders – lathe attachments, turret and capstan lathes, alignment test on lathe. **Shaping, Slotting, Planning & Drilling Machines :**Principles of working – principal parts – specifications of shaper, and planer, operations performed on shaper , principles of working – principal parts – specifications of universal drilling machine, operations performed on drilling, nomenclature of twist drill.	**12**
Unit - 3	
Milling Machines: Principles of working – specifications – classification of milling machines, principal features of horizontal, vertical and universal milling machines, machining operations, types of cutters, and geometry of milling cutters, alignment test on milling machine, accessories to milling machines, introduction to indexing, classification, methods of indexing- simple & compound	**10**
Unit - 4	
Finishing Processes: Theory of grinding, classification of grinding machines, cylindrical and surface grinding machines, tool and cutter grinding machines, different types of abrasives, bonds and selection of a grinding wheel. **CNC Machine Tools:** NC, CNC Machines, working principle, classification, constructional features of CNC machines, CNC controller, and types of motion controls in CNC machines, applications of CNC machines.	**10**
Unit-5	
Systems Of Limits and Fits: Introduction, nominal size, tolerance, limits, deviations, fits -Unilateral and bilateral tolerance system, hole and shaft basis	**10**

systems **Linear Measurements:** Length standards, end standards, slip gauges, dial indicators, micrometers. **Angular Measurements:** Bevel protractor, angle slip gauges- angle dekkor - spirit levels- sine bar - sine table. **Limit Gauges:** Taylor's principle – design of GO and NO GO gauges; plug, ring, snap, gap, taper, profile and position gauges.	

Course outcomes:

On completion of the course, student will be able to

1. Analyze mechanics of orthogonal cutting to metal machining.
2. Operate lathe, shaping, slotting, planning, drilling, milling, grinding and CNC machines.
3. Select cutting tool materials and tool geometries for different metals
4. Apply working principles of CNC Machines.
5. Design tolerances and fits for a given applications.
6. Outline different instruments used in metrology.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Production Technology by R.K. Jain and S.C. Gupta/ Hanna Publishers
2. Workshop Technology – B.S.Raghu Vamshi – Vol II/ Dhanpat Rai & Co
3. Manufacturing Technology Vol-II/P.N Rao/Tata McGraw Hill
4. Engineering Metrology / R.K.Jain / Khanna Publishers
5. Dimensional Metrology/Connie Dotson/Cengage Learning/Delmar Cengage Learning

Reference Books:

1. Metal cutting Principles by M.C. Shaw/ Oxford University Press
2. Metal cutting and machine tools by Boothroyd/ CRC Press
3. Engineering Metrology / Mahajan / Dhanpat Rai Publishers
4. Engineering Metrology and Measurements by NV Raghavendra, L Krishna Murthy, Oxford publishers

WEB SOURCE REFERENCES:

1. https://nptel.ac.in/courses/112105127/pdf/LM-26.pdf
2. http://learnmech.com/lathe-machine-attachments-lathe-application/
3. https://nptel.ac.in/courses/112105126/34

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	-	-	-	1	-	1	-	-	-	-	1	2	-
2	2	-	2	-	-	-	1	-	-	-	-	1	3	-
3	2	-	2	-	-	-	1	-	-	-	-	1	3	-
4	2	-	3	-	3	-	1	-	-	-	-	1	3	-
5	3	-	2	-	-	-	1	-	-	-	-	1	1	-
6	3	-	2	-	-	-	1	-	-	-	-	1	1	-
Course	**3**	**-**	**2**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**2**	**-**

DESIGN OF MACHINE ELEMENTS SEMESTER V			
Subject Code	18MEMET5030	Internal Marks	30
Number of Lecture Hours/Week	3(L)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Course Objectives:

This course will enable students to:

- Understand the customers' need, formulate the problem and observe the behavior of components subjected to loads
- Outline different types of modes of failure.
- Gain the knowledge of fluctuating stresses, endurance limit and fatigue failure
- Design and analyze permanent joints (riveted, welded, etc.) under concentric and eccentric loading conditions
- Develop the knowledge of designing detachable joints (bolts, cotters, etc.) under various loading conditions.
- Design and analyze coil springs (compression, tension, torsion) under various loads.

Unit-1	**Hours**
Introduction: Principles of mechanical design; Factor of safety, strength, rigidity, fracture, wear, and material considerations; Stress concentrations; Design for fatigue; Limits and fits; **Design**: Types of loads, stresses and strain, modes of failure, Principal stresses, theories of failure, Rankine theory, Guests theory, Von Mises theory, selection of failure theories	**10**
Unit-2	
Strength of Machine Elements: Theoretical stress concentration factor – fatigue stress concentration factor, notch sensitivity – design for fluctuating stresses – endurance limit – estimation of endurance strength – Goodman's line – Soderberg's line – modified Goodman's line methods.	**8**
Unit-3	
Design of Riveted Joints: Types of riveted joints, rivet heads, terminology, caulking and fullering, analysis of riveted joints, efficiency of a riveted joints, design of boiler joints and structural joints, eccentrically loaded riveted joints. **Design of Welded Joints:** Welding process, merits and demerits of welded joints over riveted joints, Types of welded joints, weld symbols, strength of parallel and fillet weld, strength of a welded joint, eccentrically loaded welded joints, welds subjected to bending moment, torsional moment	**12**
Unit-4	
Design of simple machine parts, design of cotter and knuckle joints. **Design of Threaded Joints**: Forms of screw threads, nomenclature, thread series, designation, power screws, and advantages over v-threads, stress in screwed threads, bolts of uniform strength, empirical relation for initial tightening, eccentrically loaded joints	**12**
Unit-5	
Mechanical Springs: Stresses and deflections of helical springs, extension, compression springs, springs for fatigue loading, Wahl's stress concentration factor, energy	**8**

storage capacity – helical torsion springs – co-axial springs, leaf springs, Nipping of leaf springs.	

Course Outcomes:

On completion of the course, student will be able to

1. Identify the customers' need, formulate the problem and to observe the behaviour of component subjected to loads
2. Assess the different types of failure modes and criteria.
3. Define fluctuating stresses, endurance limit and fatigue failure
4. Analyse permanent joints (riveted, welded, etc.) under concentric and eccentric loading conditions
5. Analyse detachable joints (bolts, cotters, etc.) under various loading conditions.
6. Evaluate stiffness, number of coils and length etc., of coil springs (compression, tension, torsion) under various loads.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Machine Design/V.Bandari/ TMH Publishers
2. Machine design / NC Pandya& CS Shah/Charotar Publishing House Pvt. Limited

Reference Books:

1. Design of Machine Elements / V.M. Faires/McMillan
2. Machine design / Schaum Series/McGrawHill Professional
3. Machine Design/ Shigley, J.E/McGraw Hill
4. Machine Design –Norton/ Pearson publishers

Web Sources:

1. http://nptel.ac.in/downloads/112105125/
2. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1/New_index1.htm
3. http://www.iannauniversity.com/2012/06/me2303-design-of-machine-elements_26.html
4. http://www.svecw.edu.in/Docs%5CMEDMMLnotes2013.pdf

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	-	-	-	2	-	-	-	-	2	-	2
2	2	2	3	1	-	-	-	-	-	-	-	2	-	2
3	2	2	3	1	-	-	-	-	-	-	-	2	-	2
4	2	2	3	3	-	-	-	-	-	-	-	2	-	2
5	2	2	3	1	-	-	-	-	-	-	-	2	-	2
6	2	2	3	-	-	-	-	-	-	-	-	2	-	2
Course	2	2	3	2	-	-	2	-	-	-	-	2	-	2

HEAT TRANSFER SEMESTER V			
Subject Code	18MEMET5040	Internal Marks	30
Number of Lecture Hours/Week	3(L)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES:

This course will enable students to:

- Explain concepts on heat transfer and derive general heat conduction equations. Apply heat conduction equation to various systems.
- Develop solutions for transient heat conduction in simple geometries with methods such as lumped capacitance, Heisler charts etc.
- Calculate the performance of the fins for various heat transfer applications.
- Select and apply appropriate correlations to evaluate heat transfer coefficients for forced and natural convection over exterior surfaces and flow through pipes.
- Analyze heat exchanger performance by using the method of log mean temperature difference LMTD and NTU.
- Calculate radiation heat transfer between black body surfaces, calculate radiation heat exchange between gray body surfaces.

UNIT –I	**Hours**
Introduction: Modes and mechanisms of heat transfer – basic laws of heat transfer – General discussion about applications of heat transfer. **Conduction Heat Transfer:** Fourier rate equation – general heat conduction equation in Cartesian, cylindrical and spherical coordinates. Steady, unsteady and periodic heat transfer – initial and boundary conditions. **One Dimensional Steady State Heat Conduction:** Conductive heat transfer through slab, cylinder, sphere – Homogeneous slabs, hollow cylinders – overall heat transfer coefficient– critical radius of insulation – Variable thermal conductivity – systems with heat sources or heat generation.	**14**
UNIT –II	
Extended Surfaces (Fins): Types, applications, fin materials, heat transfer from fins with uniform cross section – long fin, fin with insulated tip and short fin, Fin efficiency and Effectiveness – application to error measurement of temperature. **One Dimensional Transient Conduction:** Lumped heat capacity systems – significance of Biot and Fourier numbers.- chart solutions of transient conduction systems	**09**
UNIT – III	
Convection: Dimensional analysis– Buckingham Pi Theorem for forced and free convection – Non-dimensional numbers and their significance – concepts of continuity, momentum and energy equations. **Forced Convection:**Concepts about hydrodynamic and thermal boundary layers and their thicknesses – use of empirical correlations for convective heat transfer – flat plates, cylinders, horizontal pipe flow and annulus flow.	**09**
UNIT – IV	
Natural Convection: Development of hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for vertical plates and cylinders, horizontal plates and cylinders.	**08**

Boiling: Pool boiling – regimes- calculations on nucleate boiling, critical heat flux and film boiling. **Condensation:** Film wise and drop wise condensation –Nusselt's theory of condensation on a vertical plate – film condensation on vertical and horizontal cylinders using empirical correlations.	
UNIT-V	
Heat Exchangers: Classification of heat exchangers, temperature distribution, – overall heat transfer coefficient, fouling factor –concepts of LMTD and NTU methods – Effectiveness of the heat exchanger. **Radiation Heat Transfer:** Basic concepts and definitions: Absorptivity, Reflectivity, Transmissivity – concept of black body – Laws of radiation – heat transfer between two finite black surfaces and two grey surfaces – concept of shape factor – Emissivity — radiation shields.	**10**

COURSE OUTCOMES:

On completion of the course, student will be able to

1. Explain basic modes of heat transfer and compute temperature distribution in steady state and unsteady state heat conduction
2. Analyze heat transfer through extended surfaces
3. Interpret and analyze free & forced convection heat transfer
4. Comprehend the phenomena and flow regimes of boiling and condensation
5. Explain the principles of radiation heat transfer
6. Apply LMTD and NTU methods to design heat exchangers

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Fundamentals of Engg. Heat and Mass Transfer / R. C. Sachdeva / New Age International
2. Heat and Mass Transfer – R. K. Rajput / S. Chand revised 9th edition

Reference Books:

1. Heat and Mass Transfer –Cengel- McGraw Hill
2. Heat and Mass Transfer – Arora and Domkundwar, Dhanpatrai & Sons.
3. Heat and mass transfer - D.S.Kumar, katson publishers
4. A Text book on Heat Transfer - S.P. Sukhatme
5. Heat and mass transfer – P.K.Nag, McGraw Hill

Web Resources:

1. https://nptel.ac.in/courses/112101097/
2. https://onlinecourses.nptel.ac.in/noc18_ch08/preview
3. https://onlinecourses.nptel.ac.in/noc18_ch22/preview
4. https://nptel.ac.in/downloads/112108149/
5. https://nptel.ac.in/courses/112105129/pdf/RAC%20Lecture%207.pdf

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	-	-	-	-	-	-	-	-	2	2	-
2	2	3	2	-	-	-	-	-	-	-	-	2	2	-
3	3	3	2	-	-	-	-	-	-	-	-	3	2	-
4	3	2	2	-	-	-	-	-	-	-	-	2	2	-
5	3	3	3	-	-	-	-	-	-	-	-	3	2	-
6	2	3	2	-	-	-	-	-	-	-	-	2	2	-
Course	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**-**

HEAT TRANSFER LAB SEMESTER V			
Subject Code	18MEMEL5060	Internal Marks	50
Number of Lecture Hours/Week	3	External Marks	50
Total Number of Lecture Hours	48	Exam Hours	3

Credits –1.5

Course Objectives:

This course will enable students to:

- Illustrate basic heat transfer principles and test the thermal conductivity of a metal rod.
- Evaluate overall heat transfer coefficient in case of composite wall and heat exchanger.
- Analyze the efficiency and temperature distribution of a pinfin.
- Compare the emissivity of black and grey body.
- Estimate heat transfer coefficient in case of external flows.

List of Experiments

1. Determination of overall heat transfer co-efficient of a composite slab
2. Determination of heat transfer rate through a lagged pipe.
3. Determination of heat transfer rate through a concentric sphere.
4. Determination of thermal conductivity of a metal rod.
5. Determination of efficiency of a pin-fin.
6. Determination of heat transfer coefficient in forced convection & natural convection.
7. Determination of COP of VCR system.
8. Determination of effectiveness of parallel and counter flow heat exchangers.
9. Determination of emissivity of a given surface.
10. Determination of Stefan Boltzmann constant.
11. Determination of critical heat flux.
12. Determination of heat transfer rate in drop and film wise condensation.
13. Determination of heat transfer rate in radiator using radiator test rig.
14. Determination of heat transfer rate in twisted tape inserted co-axial heat exchanger.
15. Determination of thermal conductivity of liquids and gases.
16. Demonstration of heat pipe.

Course Outcomes:

On completion of the course, student will be able to

1. Find thermal conductivity of different common metallic materials
2. Find the quantity of heat transfer between fluids and solid boundaries
3. Evaluate the amount of heat exchanged between fluids flowing within heat exchangers
4. Explain simple experimental work in radiative heat transfer
5. Analyze different heat exchangers
6. Design heat exchangers

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	3	-	-	-	-	-	-	-	2	3	-
2	3	2	2	3	-	-	-	-	-	-	-	2	3	-
3	3	3	2	3	-	-	-	-	-	-	-	2	3	-
4	3	3	3	3	-	-	-	-	-	-	-	2	3	-
5	3	2	2	3	-	-	-	-	-	-	-	2	3	-
6	3	2	3	3	-	-	-	-	-	-	-	2	3	-
Course	3	3	3	3	-	-	-	-	-	-	-	2	3	-

MANUFACTURING AND METROLOGY LAB
SEMESTER V

Subject Code	18MEMEL5070	Internal Marks	50
Number of Lecture Hours/Week	3	External Marks	50
Total Number of Lecture Hours	48	Exam Hours	3

Credits - 02

Course Objectives:

This course will enable students to:

- Understand the parts of various machine tools.
- Know the basic operations such as turning, shaping, slotting, milling, grinding, etc
- Describe the effect of process parameters.
- Gain the knowledge of different coolants used in drilling and grinding operations.
- Measure lengths, diameters and heights
- Determine the pitch of screws and gears

List of Experiments

1. Step turning and thread cutting on lathe machine
2. Produce a hole on given specimen using drilling machine
3. Produce a flat surface on given work piece using shaping machine
4. Machining a spur gear using slotting machine
5. Producing a keyway slot using milling machine
6. Cylindrical grinding
7. Surface grinding
8. Grinding of tool angles
9. Producing flat surface using planner
10. Measurement of lengths, heights, diameters by vernier calipers, micrometers, height gauge
11. Measurement of bores by internal micrometers and dial bore indicators
12. Angle and taper measurements with bevel protractor, sine bar
13. Measurement of pitch of screw, gear and clearance angle of cutting tool by tool maker's microscope.

Course Outcomes:

On completion of the course, student will be able to

1. Acquire the knowledge of manufacturing processes.
2. Conduct experiments to understand the mechanism of chip formation.
3. Analyze various cutting parameters in different machining operations.
4. Operate different machine tools.
5. Apply the knowledge of different instruments for linear and angular measurements.
6. Choose the appropriate measuring instrument for a specific requirement

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	-	-	-	-	-	1	-	-	-	-	1	2	-
2	2	-	2	-	-	-	1	-	-	-	-	1	2	-
3	2	-	2	-	-	-	1	-	-	-	-	1	2	-
4	2	-	3	-	3	-	1	-	-	-	-	1	2	-
5	3	-	2	-	-	-	1	-	-	-	-	1	1	-
6	3	-	2	-	-	-	1	-	-	-	-	1	1	-
Course	**3**	**-**	**2**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**2**	**-**

THEORY OF MACHINES-II SEMESTER VI			
Subject Code	18MEMET6010	Internal Marks	30
Number of Lecture Hours/Week	3(L)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

COURSE OBJECTIVES:

This course will enable students to:

- Understand and analyze the gyroscopic effects under different forces and torques
- Demonstrate and analyze the existence of friction and its importance in rotating parts like clutches, brakes and dynamometers.
- Identify the dynamic forces and torques developed in the rotating parts like cranks and flywheels and to draw the turning moment diagrams.
- Classify the governors and study the effects of the centrifugal forces developed
- Distinguish and estimate the unbalanced forces and torques developed in rotating and reciprocating parts of an engine.
- Explain different types of vibrations in machine parts and evaluate their effects.

Unit -1	**Hours**
Precession: Gyroscopes, effect of precessional motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and naval ships.	**8**
Unit -2	
Friction: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis: lubricated surfaces, boundary friction, film lubrication. **Clutches**: Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch. **Brakes and Dynamometers**: Simple block brakes, internal expanding brake, band brake of vehicle. General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission	**10**
Unit - 3	
Turning Moment Diagrams: Dynamic force analysis of slider crank mechanism, inertia torque, angular velocity and acceleration of connecting rod, crank effort and turning moment diagrams – fluctuation of energy – fly wheels and their design. **Governers**: Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs,effort, sensitiveness, isochronism and hunting.	**10**
Unit - 4	
Balancing: Balancing of rotating masses single and multiple – single and different planes, using analytical and graphical methods. Primary and secondary balancing of reciprocating masses. Unbalanced forces and couples in multi cylinder engines:V-engines, in-line and radial engines for primary and secondary balancing. Locomotive balancing, hammer blow, swaying couple, variation of tractive effort.	**12**
Unit-5	
Vibrations: Introduction, Terms used in vibrations, Applications. **Longitudinal Vibrations**: Free vibration of spring mass system – Natural	**10**

frequency-types of damping – damped free vibration. **Forced Vibration:** Simple problems on forced damped vibration, magnification factor, vibration isolation and transmissibility. **Transverse Vibrations:** Transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerly's method, Rayleigh's method, whirling of shafts, critical speeds. **Torsional Vibrations**: Two and Three rotor systems.	

Course Outcomes:

On completion of the course, student will be able to

1. Analyze the effects of gyroscopic forces and torques acting on moving bodies and predict their behaviour.
2. Determine the frictional torque developed in rotating parts like clutches, brakes and dynamometers.
3. Appraise the dynamic forces and torques developed in the rotating parts like cranks and flywheels and sketch the turning moment diagrams.
4. Describe the working principles of different governors and choose their applications.
5. Develop the solutions for the unbalanced forces and torques occurring in the rotating and reciprocating parts of an engine.
6. Distinguish the types of vibrations occurring in machine parts and judge their effects.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Theory of Machines / S.S. Rattan/ Mc. Graw Hill
2. Mechanism and Machine Theory /Ashok G. Ambedkar/PHI Publications

Reference Books:

1. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
2. Theory of Machines / Shigley / MGH
3. Theory of Machines / Thomas Bevan / Oxford University Press
4. Theory of machines / Khurmi/S.Chand

Web Sources:

1. https://nptel.ac.in/courses/112104114/26
2. https://nptel.ac.in/courses/112104114/16
3. http://www.nptelvideos.in/2012/12/dynamics-of-machines.html

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	-	-	-	-	-	-	-	-	2	2	-
2	2	2	1	-	-	-	-	-	-	-	-	2	2	-
3	2	2	1	1	-	-	-	-	-	-	-	2	2	-
4	2	2	1	-	-	-	-	-	-	-	-	2	1	-
5	2	2	1	1	-	1	-	-	-	-	-	2	1	-
6	2	2	1	1	-	1	-	-	-	-	-	2	1	-
Course	2	2	1	1	-	1	-	-	-	-	-	2	2	-

PERSONALITY DEVELOPMENT & PROFESSIONAL COMMUNICATION SEMESTER VI			
Subject Code	18CMEGT6020	Internal Marks	30
Number of Lecture Hours/Week	02	External Marks	70
Total Number of Lecture Hours	32	Exam Hours	03
Pre-requisite	----	**Credits – 03**	

Aim of the Course:

Personality Development and Professional Communication skills course aims at equipping students with required skills such as personality development, interpersonal communication skills, career and employability skills, problem solving, and professional communication skills to succeed in their personal and professional life as well as to build a bright career with a clear understanding of their career values through experiential learning and performing several professional tasks.

Objectives: By the end of the course students will be able to acquire the following skills:

- Understand the process of Personality Development and learn effective methods of developing personality
- Emotional Intelligence, and Intrapersonal skills
- Career skills, Interview skills and Employability Skills
- Problem Solving skills
- Professional Communication skills

Training Methodology: The training methodology is designed to bring about changes in attitudes through experience-based learning. Activities in simulated environments such as role plays, group discussions, micro presentations, audio-video clippings, case studies, psychometric tests etc., will provide students insights into their strengths and areas for development. There will be a project work with problem analysis and presentation of the same.	**Teaching Hours 32**
Course Contents	
Unit –I	
Personality Development a) Personal Effectiveness- being proactive- principles of personal vision b) Intrapersonal communication- emotional intelligence- beginning with the end in mind- c) Time management: understanding priorities- first things first- time – personal effectiveness	**5**
Unit –2	
Emotional Intelligence and Intrapersonal Communication a) Principles of Emotional Intelligence b) Intrapersonal Communication c) Principles of creative cooperation-organization skills-Think win-win d) Principles of balanced self-renewal- Lifelong learning	**5**
Unit – 3	
Career and Employability Skills a) Understanding Career values- values grid-career thinking- what is a career? b) Skills vs strengths- spotting skills- reflecting on skills- setting goals for developing skills c) Meeting the expectations of the employer-understanding job description, Skills Grid exercises- matching the skills with requirements	**6**

d) Preparing Resume and Preparing for interviews- Structuring interview questions- CAR- Context, Action and Results	
Unit – 4	
Problem Solving Skills a) Understanding the complexity at workplace b) defining the problem- identifying the reasons c) finding possible solutions- planning actions- analysing results-feedback d) redefining the problem- the problem solving cycle	**6**
Unit – 5	
Professional Communication a) Active listening skills- note taking- b) Professional presentation skills- understanding the context- expectations of the people- putting across the message effectively- answering questions c) Technical writing skills- practical steps for writing- report writing and writing a report free from plagiarism.	**10**

Course outcomes:

On completion of the course student will be able to:

1. Understand Personality development process and learn to implement effective techniques.
2. Understand how people behave and regulate self behaviours and learn to work in a team.
3. Know their career values, indentify their skills, set goals for enhancing their career skills
4. Understand and learn how to deal with problems and practice problem solving skills.
5. Learn the principles of professional communication & application of the same
6. Face job interviews confidently and work a team effectively

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Dr. S.P. Dhanvel, English and Soft Skills, Orient Blackswan, 2011

Reference Books:

1. Seven Habits of Highly Effective People by Stephen R Covey
2. Professional Communication by Aruna Koneru, Mc Graw Hill
3. Personality Development and Soft Skills by Barun K Mitra OUP
4. Enhance Your Employability Skills-by David Winter and Laura Brammar, published by University of London -Open Courseware https://www.mooc-list.com/course/enhance-your-career-and-employability-skills-coursera
5. R.S.Agarwal, Verbal & Non-verbal Reasoning, S. Chand& Co. Latest ed.,2003

6. Stay Hungry and Stay Foolish speech by Steve Jobs You Tube video
7. https://www.mindtools.com/

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	-	-	-	-	2	2	-	-	-
2	-	-	-	-	-	-	-	-	3	2	-	-	-	-
3	-	-	-	-	-	-	-	-	-	2	2	-	-	-
4	-	-	-	-	-	-	-	-	-	-	2	2	-	-
5	-	-	-	-	-	-	-	-	-	3	-	-	-	-
6	-	-	-	-	-	-	-	-	2	2	-	-	-	-
Course	-	-	-	-	-	-	-	-	**1**	**2**	**1**	**1**	-	-

Unit	Unit Name	Text books/Reference Books	Chapter Number
I	Personality Development	T1	1,2,3
		R1	Part 2
II	Interpersonal Communication Skills	T1	2,4 and 8
		R1	Part 3
		R2	2 and 3
III	Career and Employability Skills	T1	7
		R4	4
IV	Problem Solving Skills	T1	6
		R5	7
V	Professional Communication	T1	8 and 10
		R2	3and 4

COMPOSITE MATERIALS (ELECTIVE-I) SEMESTER VI			
Subject Code	18MEMEP6031	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

COURSE OBJECTIVES:

This course will enable students to:

- Study different types, classification and applications of composite materials.
- Demonstrate and analyze different mechanical properties of composite materials
- Develop skills in understanding the analysis of fiber reinforced laminate design for different combinations of plies with different orientations of the fiber
- Understand different advanced types of composites
- Identify different techniques in designing of laminas
- Select a specific composite material under desired specification

Unit-1	**Hours**
Introduction: Introduction to composites, characteristics, classifications, advantages and limitations, industrial scenario and applications of composite materials.	**08**
Unit-2	
Hygrothermal Stresses in a Lamina: 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. **Hygrothermal Stresses and Strains in a Lamina:** Hygrothermal Stress–Strain Relationships for a Unidirectional Lamina, Hygrothermal Stress–Strain Relationships for an angle Lamina	**10**
Unit-3	
Macromechanical Analysis of a Lamina: Introduction, Definitions: Stress, Strain ,Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials. **Micromechanical Analysis of a Lamina**: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli. Macromechanical Analysis of Laminates	**10**
Unit-4	
Properties of Composites: Static mechanical properties, fatigue, impact and creep properties, fracture behaviour and damage tolerance. **Advanced composites:** Nanocomposites, hybrid composites, sandwich composites, in-situ composites, smart composites, self-healing composites, and carboncarbon composites	**12**
Unit-5	
Design of Laminates: Introduction, thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory, Failure Criterion for a Laminate, Design of a Laminated Composites.	**10**

Course Outcomes:

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

1. Obtain knowledge on classification, processing, characterization and applications

of composite materials.
2. Analyze mechanical properties and failure mechanisms of composites under different loading conditions for engineering applications
3. Outline the composite material strength and its mechanical behavior, and design different combinations of plies with different orientations of the fiber
4. Analyze different types of advanced composite materials
5. Apply various techniques to design laminates
6. Summarize the composite materials under desired conditions and specifications.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Engineering Mechanics of Composite Materials by Isaac and M Daniel Oxford University Press, 1994.
2. Analysis and performance of fibre Composites, B. D. Agarwal and L. J. Broutman, Wiley- Interscience, New York, 1980.
3. Mechanics of Composite Materials, Second Edition (Mechanical Engineering), By Autar K. Kaw, CRC Publishers

Reference Books:

1. Mechanics of Composite Materials, R. M. Jones, Mc Graw Hill Company, New York, 1975.
2. Analysis of Laminated Composite Structures, L. R. Calcote, Van Nostrand Rainfold, New York, 1969.

Web Links

1. https://nptel.ac.in/courses/112104229/2
2. https://nptel.ac.in/courses/112104249/
3. https://nptel.ac.in/courses/101104010/40
4. https://nptel.ac.in/courses/101104010/37
5. https://nptel.ac.in/courses/101104010/20

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	-	3	-	-	-	-	2	-	1	1	2	1	-
2	1	2	-	2	-	-	-	2	-	2	3	2	1	-
3	1	2	-	2	-	-	-	1	-	-	3	2	2	-
4	2	-	1	1	-	-	-	1	-	-	1	2	1	-
5	2	-	-	1	-	-	-	2	-	-	1	2	1	-
6	2	-	1	1	-	-	-	2	-	2	1	2	1	-
Course	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**1**	**2**	**2**	**1**	**-**

UNCONVENTIONAL MACHINING PROCESSES (ELECTIVE-I) SEMESTER VI			
Subject Code	18MEMEP6032	Internal Marks	30
Number of Lecture Hours/Week	3(L)+1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES:

This course will enable students to:

- Identify the need of unconventional machining processes.
- Discuss the principle, mechanism of metal removal of various unconventional machining processes.
- Apply basic principles, process variables and mechanics of metal removal and specify equipment in abrasive jet machining and water jet machining.
- Acquire the knowledge of various process parameters and their effects on the machining in different unconventional machining processes.
- List advantages, limitations and applications of unconventional machining processes.

Unit -1	**Hours**
Introduction: Need for non-traditional machining methods, classification of modern machining processes, considerations in process selection, applications. **Abrasive Jet Machining:** Basic principles, equipment, process variables, mechanics of material removal, MRR, applications and limitations	**08**
Unit -2	
Water Jet Machining : Basic principles, equipment, process variables, mechanics of material removal, MRR, applications and limitations **Ultrasonic Machining:** Elements of the process, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations	**12**
Unit – 3	
Electro–Chemical Machining: Introduction, Fundamentals of chemical machining, advantages and applications. Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM – Simple problems for estimation of metal removal rate.	**10**
Unit – 4	
Electric Discharge Machining (EDM): General principle and applications, Electric Discharge Grinding and wire EDM – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish, Machining accuracy, characteristics of spark eroded surface. **Electron Beam Machining and Laser Beam Machining:** Basic principle and theory, mechanics of material removal, process parameters, efficiency & accuracy, applications	**12**
Unit-5	
Plasma Arc Machining: Introduction, Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish	**08**

and other applications of PAM in manufacturing industries. **Finishing Processes:** Electro stream drilling, shaped tube electrolytic machining.	

Course Outcomes:

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

1. Differentiate Conventional and Non-Conventional machining and analyze the different elements of Abrasive jet Machining and its applications.
2. Analyze the working principle and applications of water jet and ultrasonic machining processes.
3. Describe the mechanism & applications of various Electro-Chemical Machining processes
4. Apply the knowledge of mechanics of material removal of EDM, EBM and LBM
5. Explain the principle of PAM & applications of plasma
6. Analyze the mechanism of material removal in finishing processes

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Advanced machining processes / Vijay K. Jain/ Allied publications.
2. Modern Machining Process / Pandey P.C. and Shan H.S./ TMH.

Reference Books:

1. Fundamentals of Machining Processes-Conventional and non – conventional processes/Hassan Abdel – Gawad El-Hafy/CRC Press-2016.
2. Unconventional machining processes/C. Elanchezhian, B. Vijaya Ramnath and M. Vijayan / Anuradha Publications
3. Non-Traditional Manufacturing Processes / Gary F. Benedict / CRC Press
4. New Technology / Bhattacharya A/ The Institution of Engineers, India 1984.

Web References

1. http://home.iitk.ac.in/~nsinha/Non-traditional-machining.pdf
2. https://www.theengineerspost.com/unconventional-machining/
3. http://mechteacher.com/unconventional-machining-processes-introduction-and-classification/

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	-	3	-	-	-	-	-	-	-	-	-	3	-
2	3	2	3	-	-	-	-	-	-	-	-	-	3	-
3	3	-	3	-	-	-	-	-	-	-	-	-	3	-
4	3	-	3	-	-	-	-	-	-	-	-	-	3	-
5	3	1	3	-	-	-	-	-	-	-	-	-	3	-
6	3	1	3	-	-	-	-	-	-	-	-	-	3	-
Course	**3**	**1**	**3**	-	-	-	-	-	-	-	-	-	**3**	-

INTERNAL COMBUSTION ENGINES (ELECTIVE-I) SEMESTER VI			
Subject Code	18MEMEP6033	Internal Marks	30
Number of Lecture Hours/Week	3(L)+1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

- Know the Air Standard Cycles, Fuel Air Cycles and Actual Cycles.
- Understand the working of various internal combustion engines and its components.
- Learn various combustion processes and design of combustion chambers in SI engines.
- Acquire knowledge of various combustion processes and design of combustion chambers in CI engines.
- Examine the performance of IC engines and its parameters.
- Obtain knowledge of emission measuring techniques and alternate fuels.

Unit -1	**Hours**
Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.	**10**
Unit -2	
IC ENGINES : Classification - Working principles, Valve and Port Timing Diagrams, Fuel, Carburetor. Engine systems – Fuel Injection System, Ignition, Cooling and Lubrication, principle of Wankle engine, principles of supercharging and turbo charging.	**8**
Unit – 3	
Combustion in S.I. Engines: Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Types of Abnormal combustion, pre-ignition and knocking– Fuel requirements and fuel rating, anti-knock additives, combustion chamber – requirements, types. **Combustion in C.I. Engines:** Four stages of combustion – delay period and its importance – Effect of engine variables – diesel knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.	**12**
Unit – 4	
Testing and Performance of I.C. Engines: Parameters of performance - cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.	**12**
Unit-5	
Engine Emissions: Spark Ignition and Compression Ignition engine emissions. Harmful effects. Emission measuring methods. Methods for controlling emissions. EURO and BHARAT emission norms. **Alternate Fuels For IC Engines:** Need for use of alternate fuels. Alcohol Fuels, Biodiesel, Biogas and Hydrogen.	**08**

Course Outcomes:

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

1. Analyze the Air Standard Cycles, Fuel Air Cycles and Actual Cycles
2. Explain various internal combustion engines working principles and analyze various engine systems.
3. Illustrate various combustion processes and design of combustion chambers in S.I. engines.
4. Describe various combustion processes and design of combustion chambers in C.I. engines
5. Evaluate the performance parameters of I.C. Engines.
6. Outline the emission measuring techniques and various alternate fuels.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. I.C. Engines / V. Ganesan- TMH
2. Heat engines, Vasandani & Kumar publications Thermal

Reference Books:

1. Thermal Engineering / RK Rajput/ Lakshmi Publications
2. IC Engines – M.L.Mathur &R.P.Sharma – Dhanpath Rai & Sons.
3. I.C.Engines–Applied Thermosciences–C.R.Ferguson & A.T.Kirkpatrick-2nd Edition- Wiley Publ
4. I.C. Engines - J.B.Heywood /McGrawHIll.
5. Thermal Engineering – R.S.Khurmi & J.S.Gupta- S.Chand Publ
6. Thermal Engineering / PL Ballaney, Khanna Publisher

Web Links:

1. https://nptel.ac.in/courses/103105110/m5l40.pdf
2. https://nptel.ac.in/courses/112104033/pdf_lecture/lecture1.pdf
3. https://nptel.ac.in/courses/112104033/27
4. http://www.iitg.ernet.in/scifac/qip/public_html/cd_cell/chapters/uk_saha_internal_combustion engine/qip-ice-09-actual%20cycles.pdf

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	-	-	-	-	-	-	-	-	-	2	3	-
2	3	3	-	-	-	-	-	-	-	-	-	2	3	-
3	3	3	-	-	-	-	-	-	-	-	-	2	3	-
4	2	3	-	-	-	-	-	-	-	-	-	2	3	-
5	2	3	-	-	-	-	-	-	-	-	-	2	3	-
6	3	3	-	-	-	-	2	-	-	-	-	2	3	-
Course	**3**	**3**	-	-	-	-	**2**	-	-	-	-	**2**	**3**	-

POWER PLANT ENGINEERING (ELECTIVE-II) SEMESTER VI			
Subject Code	18MEMEP6041	Internal Marks	30
Number of Lecture Hours/Week	3(L)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Course Objectives:

This course will enable students to:

- Acquire knowledge on sources of energy and Different types of Power Plants
- Understanding of Thermal Power Plant Operation, turbine governing, different types of high pressure boilers including supercritical and supercharged boilers, Fluidized bed combustion systems.
- Acquire knowledge on working of Diesel and Gs Power Stations and their auxiliaries. To learn the basic concepts of different hydroelectric power plants and also gain knowledge on various curves which are associated with water flow.
- Basic knowledge of Different types of Nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.
- Acquire knowledge on principles of Non-conventional Power Stations and their auxiliaries
- Understanding of Power Plant Economics and Discussing environmental and safety aspects of power plant operation.

Unit -1	**Hours**
Introduction to the sources of energy – resources and development of power in india. **Steam Power Plant:** Plant layout, working of different circuits, fuel and handling equipment, types of coals, coal handling, choice of handling equipment, coal storage, ash handling systems. properties of coal , overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, dust collectors, cooling towers and heat rejection. corrosion and feed water treatment.	**10**
Unit -2	
Diesel Power Plant: Plant layout with auxiliaries, fuel supply system, air starting equipment, supercharging. **Gas Turbine Plant:** Introduction, classification, construction, layout with auxiliaries, combined cycle power plants and comparison. **Hydro Electric Power Plant:** Water power, hydrological cycle / flow measurement, drainage area characteristics, hydrographs, storage and pondage, classification of dams and spill ways. **Hydro Projects and Plant:** Classification, typical layouts, plant auxiliaries, plant operation pumped storage plants.	**14**
Unit – 3	
Nuclear Power Station: Nuclear fuel – breeding and fertile materials – nuclear reactor – reactor operation. **Types of Reactors:** Pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast breeder reactor, homogeneous reactor, gas cooled reactor, radiation hazards and shielding – radioactive waste disposal.	**8**

Unit – 4	
Non-Conventional Power Plants: Geothermal power plants, Tidal power plants, Wind power plants, solar power plants, Bio gas, and Fuel cell power systems.	**9**
Unit-5	
Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, load curves, load duration curve, definitions of connected load, maximum demand, demand factor, average load, load factor, diversity factor, related exercises. effluents from power plants and Impact on environment, pollutants and pollution standards –methods of pollution control	**9**

Course Outcomes:

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

1. List, describe the main sources of energy, including those that are currently used and those that may be used in future
2. Describe the functions of the major equipment and auxiliaries of a steam power plant
3. Identify, demonstrate the components of a IC Engine power plant and Gas Turbine power plants and describe the functions of the major equipment and auxiliaries of a hydro power plant.
4. Explain the basic principles of nuclear reactions and Explain working principle of different types of nuclear power plants.
5. Explain the working principles of Non-Conventional power plants
6. Determine performance of power plants based on load variations and Analyze economics of power plants based on factors affecting the power plants

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill
2. A Course in Power Plant Engineering – Arora, Domkundwar – Dhanpat Rai & Co.

Reference Books:

1. A Text Book of Power Plant Engineering – R.K. Rajput – Laxmi Publications.
2. An Introduction to Power Plant Technology / G.D. Rai/Khanna Publishers.
3. Power Plant Engineering – G. R. Nagpal – Khanna Publishers
4. Power Plant Technology, El Wakil M.M.,Tata McGraw Hill

Web references:

1. https://nptel.ac.in/courses/108105058/8
2. https://nptel.ac.in/courses/112107216/
3. https://nptel.ac.in/courses/112103243/
4. https://nptel.ac.in/courses/108108078/

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	3	1	-	1	2	1	-	-	-	1	2	2	-
2	-	1	2	-	-	-	-	-	-	-	-	1	2	-
3	-	1	2	-	-	-	-	-	-	-	-	1	1	-
4	-	-	2	-	1	-	-	-	-	-	-	2	1	-
5	-	-	-	-	3	2	3	-	-	-	2	2		-
6	-	-	-	-	-	-	3	-	-	-	2	2		-
Course	-	2	2	-	1	2	2	-	-	-	1	2	2	-

CAD/CAM (ELECTIVE-II) SEMESTER VI			
Subject Code	18MEMEP6042	Internal Marks	30
Number of Lecture Hours/Week	3(L)+1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES:

This course will enable students to:

- acquire knowledge on fundamentals of CAD/CAM, Computer graphics and transformation geometry.
- get acquainted with the mathematical models to represent curves and surfaces.
- model the engineering components using solid modelling techniques.
- develop CNC program and APT language to manufacture industrial components
- understand the elements of an automated manufacturing environment
- learn the overall configuration and elements of computer integrated manufacturing systems.

Unit -1	**Hours**
Introduction to CAD/CAM: Introduction to CAD/CAM/CIM, Automation, Product cycle, Design process, CAD/CAM hardware: basic structure, CPU, memory types, input and output devices, display devices, hard copy devices, storage devices. **Fundamentals of Computer Graphics:** Raster scan graphics coordinate system, Database structure for graphics modeling, clipping, hidden surface removal. **Transformations of Geometry:** Translation, Scaling, Reflection, Rotation, Homogeneous representation of transformation, Concatenation of transformations.	**10**
Unit -2	
Geometric Modelling of Curves: Wire frame modelling, Wireframe entities, Curve representation, Parametric representation of analytic curves, Parametric representation of Hermite cubic spline, Bezier and B-spline curves. **Geometric Modelling of Surfaces:** Surface modeling, Basic surface entities, Parametric representation of analytic & Synthetic surfaces. **Geometric Modelling of Solids:** Solid modeling, Solid entities, Boolean operations, Boundary representation of Solid Modelling, CSG approach of solid modelling.	**10**
Unit – 3	
Computer Aided Manufacturing (CAM): Introduction to Computer Numerical Control (CNC), Basic components of NC system, NC coordinate system, Motion control systems, Feedback devices, CNC tooling, features of machining center, turning center. **CNC Programming:** Part programming fundamentals, Manual Part Programming, Computer assisted part programming, APT Programming, Geometric & motion commands, Post processor commands.	**10**
Unit – 4	
Group Technology: 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 and	**10**

applications. **Computer Aided Process Planning (CAPP):** Introduction to CAPP, Variant & Generative methods of CAPP, Benefits of CAPP.	
Unit-5	
Computer Aided Quality Control: Introduction, Terminology in Quality control, Computer in QC, contact and noncontact inspection techniques, computer aided testing, integration of CAQC with CAD/CAM. **Computer Integrated Manufacturing Systems:** Introduction to CIM, Scope of CIM, Types of manufacturing systems, machine tools and related equipment, material handling systems, material requirement planning, computer control systems, human labor in manufacturing systems, CIMS benefits.	**10**

COURSE OUTCOMES:

On completion of the course, student will be able to

1. Execute the fundamentals of CAD/CAM, Computer graphics and transformation geometry.
2. Develop the mathematical models to represent curves and surfaces.
3. Model the engineering components using solid modelling techniques.
4. Create CNC program and APT language to manufacture industrial components
5. Explain the elements of an automated manufacturing environment
6. Analyze the overall configuration and elements of computer integrated manufacturing systems.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Automation, Production Systems and Computer Integrated Manufacturing, Mikell P. Groover, Prentice-Hall of India Pvt. Ltd
2. CAD/CAM: Computer Aided Design and Manufacturing, Grover M. P. and Zimmers E.W., PHI Learning Private Limited
3. CAD/CAM, Ibrahim Zeid, Tata McGrawhill, Delhi

Reference Books:

1. CAD/CAM Principles and Applications, P.N. Rao, Tata McGraw Hill, New Delhi
2. Computer Control of Manufacturing Systems, YoramKoren, McGraw Hill Publications
3. CAD/CAM/CIM, by P.Radhakrishnan, S. Subramanyan and V.Raju, New Age International Publications
4. Computer Aided Manufacturing, C.Elanchezhian, T.Sunder Selwyn, Laxmi Publications Private Limited
5. CNC Machines, B.S.Pabla and M.Adithan, New Age International Publications

Web References:

1. https://nptel.ac.in/courses/112102101/44

2. https://nptel.ac.in/courses/112104228/31
3. https://nptel.ac.in/courses/112102103/17
4. https://nptel.ac.in/courses/112102103/Module%20G/Module%20G(2)/p1.htm
5. https://nptel.ac.in/courses/Webcourse-contents/IIT Delhi/Computer%20Aided%20Design%20&%20ManufacturingI/index.htm

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	2	3	1	-	-	-	-	-	1	-	2
2	3	2	1	2	3	1	-	-	-	-	-	1	-	3
3	2	2	1	2	3	1	-	-	-	-	-	1	-	3
4	2	2	1	2	3	2	-	-	-	-	-	1	2	-
5	2	2	1	2	3	2	-	-	-	-	-	1	2	-
6	2	2	1	2	3	2	-	-	-	-	-	1	2	-
Course	**2**	**2**	**1**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**

DESIGN FOR MANUFACTURE (ELECTIVE-II) SEMESTER VI			
Subject Code	18MEMEP6043	Internal Marks	30
Number of Lecture Hours/Week	3(L)+1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES:

This course will enable students to:

- Gain knowledge on basic principles of design for manufacturing processes
- Simulate the casting design and ability to identify the best casting process
- Differentiate the components for different machines
- Describe the design rules for machining with single point and multi point cutting tools.
- Distinguish between manual assembly and automated assembly.

Unit -I	**Hours**
Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design. Design for the life cycle total product life of consumer goods-design considerations.	**08**
Unit -II	
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.	**12**
Unit – III	
Design for Injection Molding: Injection molding systems, Molds, molding cycle time, mold cost estimation, estimation of optimum number of cavities, Assembly techniques, Design Guidelines. **Design for Hot Forging**: Characteristics of the forging process, forging allowances, flash removal, die cost estimation, die life and tool replacement costs	**10**
Unit – IV	
Extrusion & Sheet Metal Work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking. **Machining Processes:** Overview of various machining processes-general design rules for machining. General design recommendations for machined parts.	**12**
Unit – V	
Design for Assembly: Design guidelines for manual assembly, large assemblies, analysis of an assembly, rules for product design for automation, design for robot assembly, Design for manufacture and Computer aided design machining.	**08**

COURSE OUTCOMES:

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

1. Understand the basic principles of design for manufacturing and assembly
2. Implement the design principles for manufacturing processes

3. Apply the casting design for the best casting process to a product.
4. Design components for various machines used in the manufacturing process
5. Implement the design rules for machining with single point and multi point cutting tools.
6. Identify the differences between the design for manual assembly and automated assembly.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Geoffrey Boothroyd, Dewhurst.P, Knight.W, roduct design for manufacture and assembly, CRC press, 2002
2. George E Dieter, Engineering Design- A material processing approach, 5/E. Mc Graw hill international, 2003

Reference Books:

1. ASM Handbook, Design for manufacture, 2000.

Web References:

1. https://nptel.ac.in/courses/112101005/
2. https://quality-one.com/dfm-dfa/
3. http://www.design4manufacturability.com/DFM_article.htm

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	1	1	-	-	-	-	1	-	1	2	-
2	3	3	1	2	2	1	-	-	-	1	-	1	2	-
3	3	2	2	2	2	2	2	2	-	1	-	1	2	-
4	3	3	1	2	2	-	-	-	-	-	-	1	2	-
5	3	3	1	1	1	1	1	-	-	1	-	1	2	-
6	3	1	-	-	-	1	-	-	-	-	-	1	2	-
Course	3	2	2	2	2	1	2	2	-	1	-	1	2	-

THEORY OF MACHINES LAB SEMESTER VI			
Subject Code	18MEMEL6060	Internal Marks	50
Number of Practice Hours/Week	03	External Marks	50
Total Number of Practice Hours	48	Exam Hours	03
Credits – 1.5			

Course Objectives:

This course will enable students to:

- Understand the whirling speed of shaft theoretically and experimentally and compare them.
- Gain fundamental knowledge of dynamics of machinery so that he/she can appreciate problems of dynamic force balancing and frictional forces developed.
- Learn analytical and graphical methods for calculating the unbalanced forces and torques due to rotary and reciprocating masses of an engine
- Analyse different types of vibrations and their significance in designing machine components.
- Acquire the knowledge of flywheel design and the effects of gyroscopic couple.
- Classify gears and draw the cam profile for different types of cam follower systems.

List of Experiments (Any 10 experiments must be conducted)

1. To determine whirling speed of shaft theoretically and experimentally.
2. To determine the position of sleeve against controlling force and speed of a governor and to plot the characteristic curve of radius of rotation.
3. To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis
4. To determine the frequency of undamped free vibration of spring mass system.
5. To determine the frequency of damped force vibration of a spring mass system
6. To study the static and dynamic balancing using rigid blocks.
7. To find the moment of inertia of a flywheel
8. To plot follower displacement vs cam rotation for various Cam Follower systems.
9. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism/Four bar mechanism
10. To find coefficient of friction between belt and pulley.
11. To study simple and compound screw jack and determine the mechanical advantage , velocity ratio and efficiency
12. To Demonstration various types of gears: Spur, Helical, Worm and Bevel Gears.

Course Outcomes:

On completion of the course, student will be able to

1. Compare the whirling speed of the shaft theoretically and experimentally
2. Compute frictional torque transmitted by the mechanical components.
3. Demonstrate balancing of reciprocating and rotary masses.
4. Determine the natural frequencies of continuous systems.
5. Analyze stabilization of sea vessels, aeroplanes and automobile vehicles
6. Plot the cam Profile for different cam follower systems.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	-	-	-	2	-	-	-	-	-	2	2	-
2	2	2	-	-	-	-	-	-	-	-	-	2	2	-
3	2	2	-	-	-	-	-	-	-	-	-	2	2	-
4	2	2	-	-	-	2	-	-	-	-	-	2	2	-
5	2	2	-	-	-	-	-	-	-	-	-	2	2	-
6	2	2	-	-	-	2	-	-	-	-	-	2	2	-
Course	2	2	-	-	-	2	-	-	-	-	-	2	2	-

THERMAL ENGINEERING LAB SEMESTER VI			
Subject Code	18MEMEL6070	Internal Marks	50
Number of Lecture Hours/Week	03	External Marks	50
Total Number of Lecture Hours	48	Exam Hours	03
Credits –1.5			

Course objectives:

This course will enable students to:

- Sketch the valve timing diagram and port timing diagram for single cylinder four stroke diesel engine and two stroke petrol engine.
- Calculate the mechanical efficiency of four stroke SI engine by Morse test.
- Evaluate the performance of four stroke single cylinder CI engine & Predict actual diagram.
- Illustrate the assembly and disassembly of four stroke single cylinder petrol engine.
- Analyze the performance testing of variable compression ratio petrol engine.
- Determine the fuel properties of various fuels used in IC engines.

I. I C ENGINE VALVE / PORT TIMING DIAGRAM :

1. Valve timing diagram of a four stroke Diesel Engine.
2. Valve timing diagram of a four stroke Petrol Engine.
3. Port timing diagram of 2-stroke Petrol Engine.

II. FOUR STROKE DIESEL ENGINE :

4. Performance test on four stroke diesel engine test rig.
5. Heat balance test on four stroke diesel engine test rig.
6. Retardation test on four stroke diesel engine test rig.

III. FOUR STROKE PETROL ENGINE :

7. Morse test on four stroke multi cylinder petrol engine test rig.
8. Performance test on variable compression ratio petrol engine test rig.
9. Assembly and disassembly of a four stroke single cylinder petrol engine.

IV. TWO STROKE PETROL ENGINE:

10. Performance test on Two stroke petrol engine test rig.
11. Economical speed test on Two stroke petrol engine test rig.

V.BOILERS:

12. Study of steam boilers.

VI. AIR COMPRESSOR:

13. Performance test on reciprocating air compressor test rig.

VII. FUEL PROPERTY TESTING:

14.To find the flash point / fire point, viscosity, calorific value& carbon residue by using fuel property testing machines.

Course outcomes:

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

1. Sketch the valve timing diagram and port timing diagram for single cylinder four stroke diesel engine and two stroke petrol engine
2. Conduct constant speed and variable speed tests on IC engines and interpret their performance.
3. Estimate energy distribution by conducting heat balance test on IC engines
4. Calculate the mechanical efficiency of four stroke SI engine by Morse test.
5. Examine the performance testing of variable compression ratio petrol engine.
6. Measure the fuel properties of various fuels used in IC engines.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	-	-	-	-	-	-	-	-	-	2	3	-
2	3	3	-	-	-	-	-	-	-	-	-	2	3	-
3	3	3	2	-	-	-	2	-	-	-	-	2	3	-
4	2	3	2	-	-	-	2	-	-	-	-	2	3	-
5	2	3	2	-	-	-	2	-	-	-	-	2	3	-
6	3	3	2	-	-	-	3	-	-	-	-	2	3	-
Course	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

MODELLING & SIMULATION LAB SEMESTER VI			
Subject Code	18MEMEL6080	Internal Marks	50
Number of Lecture Hours/Week	04	External Marks	50
Total Number of Lecture Hours	48	Exam Hours	03
Credits –2			

Course objectives:

This course will enable students to:

- Understand modeling tools for drawing machine components
- Gain the knowledge of 3D & Assembly drawing of machine components
- Know simulation Software for analyzing machine components.
- Analyze the structural, thermal & model analyses problems
- Prepare simple parts on the CNC Machining center.

1. DRAFTING :

Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances scanning and plotting. Study of script, DXE and IGES files

2.PART MODELING:

Generation of various 3D models through protrusion, revolve, shell, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling surface and assembly modeling. Study of various standard translators. Design simple components.

3. STRUCTURAL AND THERMAL ANALYSIS

a) Determination of deflection and stresses in 2D and 3D trusses and beams.
b) Determination of deflections in component and principal and Von-mises stresses in plane stress, plane strain and axi-symmetric components.
c) Determination of stresses in 3D and shell structures (at least one example in each case)
d) Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
e) Steady state heat transfer analysis of plane and Axi-symmetric components.

4. CNC MACHINING

a) Study of various post processors used in NC Machines.
b) Machining of simple components on NC lathe by transferring NC Code /from a CAM package.
c) Practice on CNC Sinutrain Turning
d) Practice on CNC Sinutrain Milling
e) CNC programming for turning of components using FANUC Controller
f) CNC programming for milling of components using FANUC Controller
Automated CNC Tool path & G-Code generation using Pro-E/Master CAM.

Course outcomes:

On Completion of this course, the students will be able to:

1. Identify the various sketch and part design tools in modeling software
2. Draw machine components by modeling software
3. Apply the knowledge of 3D & assembly drawing
4. Solve 2D structural and axi-symmetric problems using analysis software
5. Compute heat transfer problems using analysis software
6. Prepare part programme for engineering components on CNC Machining center

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2	-	-	-	-	-	-	-	2	-	3
2	3	3	2	2	-	-	-	-	-	-	-	2	-	3
3	3	3	2	2	-	-	-	-	-	-	-	2	-	3
4	3	3	2	2	-	-	-	-	-	-	-	2	-	3
5	3	3	2	2	-	-	-	-	-	-	-	2	-	3
6	3	3	2	2	-	-	-	-	-	-	-	2	-	3
Course	3	3	2	2	-	-	-	-	-	-	-	2	-	**3**

DESIGN OF TRANSMISSION SYSTEMS SEMESTER VI			
Subject Code	18MEMEN6090	Internal Marks	30
Number of Lecture Hours/Week		External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits -0			

Course Objectives:

This course will enable students to:

1. Design and Analyze the pressure distribution in journal bearings
2. List out engine components such as cylinder, piston, connecting rod and crankshaft.
3. Summarize the design procedure for shafts and couplings with different geometrical features under various loading conditions
4. Determine geometrical relations for length of belt and chain
5. Distinguish types of pulleys/sprockets for belt and chain drives from manufacture's catalogue.
6. Explain procedure for beam strength and wear strength, effective load and module based on beam strength.

Unit-1	**Hours**
Bearings: Classification of bearings- applications, types of journal bearings – lubrication – bearing modulus – full and partial bearings – clearance ratio – heat dissipation of bearings, bearing materials – journal bearing design – ball and roller bearings – static loading of ball & roller bearings, bearing life	**10**
Unit-2	
Engine Parts: Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – cranks and crank shafts, strength and proportions of over hung and center cranks – crank pins, crank shafts. Pistons, forces acting on piston – construction design and proportions of piston, cylinder, cylinder liners,	**10**
Unit-3	
Shafts: Design of solid and hollow shafts for strength and rigidity, Design of shafts for combined bending and axial loads – Shaft sizes, BIS code. Use of internal and external circlips, gaskets and seals (stationary & rotary). **Shaft Couplings:** Rigid couplings: Muff, Split-muff and flange couplings – Flexible couplings, Flange coupling (modified).	**10**
Unit-4	
Design of Belt and Rope Drives: Selection of flat belts, Pulleys for flat belts, Arms of cast iron pulley, Selection of V-belts and V-grooved pulley, Construction of wire rope, Stresses in wire ropes, Rope sheaves and drums. **Design of Chain Drives:** Introduction to chain drives, Roller chains, geometric relationships, Polygonal effect, Power rating of roller chains, Proportions of sprocket wheels, Design of chain drive.	**10**
Unit-5	
Design of Spur Gear Drives: Force analysis on spur gear tooth, Gear blank design, module and face width, Beam strength of gear tooth, Effective load on gear tooth, Lewis Fatigue equation, Estimation of module based on beam strength, Wear strength of gear tooth, Estimation of module based on wear strength, **Design of Helical Gear Drives:** Force analysis on helical gear tooth, Beam	**10**

strength of helical gears, Effective load on gear tooth, Wear strength of helical gears, Herringbone gears.	

COURSE OUTCOMES:

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

1. Analyze the pressure distribution in journal bearings
2. Compute design parameters of engine components such as cylinder, piston, connecting rod and crankshaft
3. Analyze shafts and couplings with different geometrical features under various loading conditions
4. Calculate geometrical relations for length of belt and chain
5. Identify types of pulleys/sprockets for belt and chain drives from manufacture's catalogue
6. Learned calculation procedure for beam strength and wear strength, effective load and module based on beam strength.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Machine Design/V.Bandari/ TMH Publishers
2. Machine design / NC Pandya& CS Shah/Charotar Publishing House Pvt. Limited

Reference Books:

1. Design of Machine Elements / V.M. Faires/McMillan
2. Machine design / Schaum Series/McGrawHill Professional
3. Machine Design/ Shigley, J.E/McGraw Hill
4. Machine Design –Norton/ Pearson publishers

Web Sources:

1. http://nptel.ac.in/courses/112105124/
2. http://www.nptel.ac.in/downloads/112105125/
3. http://nptel.ac.in/courses/112106137/
4. http://freevideolectures.com/Course/2363/Design-of-Machine-Elements-I/36
5. http://www.nptelvideos.in/2012/12/design-of-machine-elements.html

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	-	-	-	2	-	-	-	-	2	-	2
2	2	2	3	1	-	-	-	-	-	-	-	2	-	2
3	2	2	3	1	-	-	-	-	-	-	-	2	-	2
4	2	2	3	3	-	-	-	-	-	-	-	2	-	2
5	2	2	3	1	-	-	-	-	-	-	-	2	-	2
6	2	2	3	-	-	-	-	-	-	-	-	2	-	2
Course	2	2	3	2	-	-	2	-	-	-	-	2	-	2

B.Tech. (Mechanical Engineering)

Semester VII (Fourth Year)

Sl. No.	Course Code	Course Title	L	T	P	C	I	E	T
1.	18MEMET7010	Operation Research	3			3			
2.	18MEMET7020	Instrumentation & Control Systems	3			3			
3.	18MEMEP703X	Elective-III	3			3			
4.	18MEMEP704X	Elective-IV	3			3			
5.	18MEXXO705X	Open Elective-III	3			3			
6.	18MEMEL7060	Instrumentation Lab			3	1.5			
7.	18MEMEC7070	Internship with Seminar			4	2			
8.	18MEMER7080	Project Phase-I			8	4			
		Total	**15**		**15**	**22.5**			

B.Tech. (Mechanical Engineering)

Semester VIII (Fourth Year)

Sl. No.	Course Code	Course Title	L	T	P	C	I	E	T
1.	18MEMET8010	Automation in Manufacturing	3			3			
2.	18MEMEP802X	Elective-V	3			3			
3.	18MEMEP803X	Elective-VI	3			3			
4.	18MEMEO804X	Open Elective-IV	3			3			
5.	18MEMER805X	Project Phase-II			14	7			
6.	18MEMCN8060	Co Curricular and Extra Curricular Activity (Mandatory Course)	3						
		Total	**12**		**14**	**19**			

Program Elective Courses:

Elective -I	18MEMEP6041	1.Composite Materials
	18MEMEP6042	2.Un-Conventional Machining Processes
	18MEMEP6043	3. Internal Combustion Engines
Elective -II	18MEMEP6061	1. Power Plant Engineering
	18MEMEP6062	2. CAD/CAM
	18MEMEP6063	3. Design for Manufacture
Elective -III	18MEMEP7051	1.Gas Dynamics & Jet Propulsion
	18MEMEP7052	2. Finite Element Methods
	18MEMEP7053	3 Flexible Manufacturing Systems
Elective -IV	18MEMEP7061	1. Automobile Engineering
	18MEMEP7062	2.Mechatronics
	18MEMEP7063	3.Additive Manufacturing
Elective -V	18MEMEP8031	1.Energy Conservation & Management
	18MEMEP8032	2.Non Destructive Evaluation
	18MEMEP8033	3. Solid Mechanics
Elective -VI	18MEMEP8041	1. Refrigeration and Air Conditioning
	18MEMEP8042	2. Computational Fluid Dynamics
	18MEMEP8043	3.Quality & Reliability Engineering

Open Elective Courses offered by Dept. of ME to Other Depts.

1	Operations Research (except ME)	
2	Robotics	
3	Advanced Optimization Techniques	
4	Green Engineering Systems	
5	Production Planning and Control	
6	Nano Technology	

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IV B.Tech I Semester (Mechanical Engineering)
Autonomous Batch starting from A.Y. 2018-19

OPERATIONS RESEARCH			
Subject Code	18MEMET7010	IA Marks	30
Number of Lecture Hours/Week	3(L)+1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Course Objectives:

1. Understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand.
2. Understand the relationship between a linear program and its dual, including strong duality and complementary slackness.
3. Solve specialized linear programming problems like the transportation and assignment problems.
4. Solve network models like the shortest path, minimum spanning tree, and maximum flow problems.
5. Model formulation and applications that are used in solving business decision problems.

Unit -1	**Teaching Hours**
Development – definition– characteristics and phases – types of operation research models – applications. **Linear Programming Problem:** Introduction to OR, Linear Programming, Mathematical Formulation of the problem, Graphical Solution. General LPP, Canonical and standard form of LPP. Simplex Method: Introduction, Computational Procedure, Use of artificial variables,	**Hours – 10**
Unit -2	
Transportation Problem: Introduction, LP formulation of Transportation Problem, The Transportation Table, Solution of Transportation problem, Finding IBFS: North-West Corner rule, Least – cost Method and VAM, Test for Optimality. **Assignment Problem:** Introduction, Mathematical Formulation of the Problem, Hungarian Assignment Method only, Special Cases in Assignment Problems, formulation of the Traveling Salesman Problem.	**Hours – 12**
Unit - 3	
Sequencing Problem: Introduction, Problem of Sequencing, Processing n jobs through two machines. Processing n jobs through k machines, Processing 2 jobs through two machines. **Replacement Problem:** Introduction, Replacement of items that deteriorate gradually, Replacement of items that fails suddenly.	**Hours – 08**
Unit – 4	
Inventory Control: Introduction, Types of Inventories, Costs associated with inventories, the concept of EOQ, Deterministic inventory problems with no shortages, with shortages **Queuing Theory**: Introduction, Queuing system, elements of Queuing	**Hours – 12**

system Operating characteristics of a Queuing system, Classification of queuing models: Model-I [M/M/1:∞ / FIFO], Model-III [M/M/1: N/FIFO].	
Unit-5	
GAME THEORY: Introduction, Two Person Zero sum games, Maximin - Minimax principle, Games without saddle points- mixed strategies, Graphical solution of 2Xn, mX2 games, and Dominance property, P-system, S-system, Q-system and Ss-system PROJECT MANAGEMENT PERT & CPM: Introduction, construction of networks, calculation of EST, EFT, LST, LFT, and total elapsed time.	**Hours – 08**

Course Outcomes:

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

1. **Formulate** and solve mathematical model (linear programming problem) for a physical situations like production and distribution of goods.
2. **Apply** the concept of simplex method and its extensions to dual simplex algorithm.
3. **Solve** the problem of transporting the products from origins to destinations with least transportation cost.
4. **Convert** and **solve** the practical situations of sequencing and replacement problem.
5. **Identify** the resources required for a project and generate a plan and work schedule.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Operations Research / A.M.Natarajan, P. Balasubramani, A. Tamilarasi / Pearson Education.

Reference Books:

1. Operations Research / S.D.Sharma-KedarnathRamnath(JNTU)
2. Operations Research / R.Pannerselvam / PHI Publications.
3. Operation Research /J.K.Sharma/MacMilan.
4. Operation Research /Premkumar Gupta, D.S.Hira / S.Chand
5. Operation Research An Introduction / Taha / Pearson
6. Operation Research / KanthiSwarup, P.K Gupta, Man Mohan / Sultan Chand & sons

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	0	0	0	0	0	0	2	0	0	0	0	0
2	2	2	0	0	0	0	0	0	2	0	0	0	0	0
3	2	2	2	0	0	0	0	0	2	0	0	0	0	0
4	2	2	0	0	0	0	0	0	2	0	0	0	0	0
5	2	2	2	0	0	0	0	0	0	0	1	1	0	0
Over all	2	2	1	0	0	0	0	0	2	0	1	1	0	0

Course: Operations Research

S. No.	Unit Name	Text Book Reference	Page No.
6.	**Linear Programming Problem**	**T1**	31,34,45,51,74,87,113,127
		T2	1,8,13,43,30,49,56
		T3	1,9,21,25,30
		T4	1,10,33,98,38,131,148
		T5	1,21,41,45,114,45,154,181
7.	**Transportation Problem**	**T1**	195,199,202,211,276,278,336
		T2	167,170,172,184,229,238,250
		T3	71,73,77,78,127,130
		T4	317,320,329,389,403,422
		T5	248,249,251,314,355,359,423
8.	**Sequencing Problem**	**T1**	320,325,330,342,360
		T2	361,366,370,393,406
		T3	471
		T4	958,964,971,782,783
		T5	445,460,465,1052,1078
9.	**Inventory Control**	**T1**	463,469,472,492,412,439
		T2	425,430,436,443,495,507,526
		T3	230,231,238,298,301,309
		T4	597,606,608,627,712,726
		T5	1098,1103,1127,963,1012
10.	**GAME THEORY**	**T1**	379,382,388
		T2	303,305,327,334,328,545,546
		T3	424,426,428,440,430,355,359, 368
		T4	484,488,495,508,495,526,529, 533
		T5	854,858,864,876,1240,1276

Text Books:

1. Operations Research / A.M.Natarajan, P. Balasubramani, A. Tamilarasi / Pearson Education.

Reference Books:

1. Operations Research / S.D.Sharma-KedarnathRamnath(JNTU)
2. Operations Research / R.Pannerselvam / PHI Publications.
3. Operation Research /J.K.Sharma/MacMilan.
4. Operation Research /Premkumar Gupta, D.S.Hira / S.Chand
5. Operation Research An Introduction / Taha / Pearson
6. Operation Research / KanthiSwarup, P.K Gupta, Man Mohan / Sultan Chand & sons

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IV B.Tech I Semester (Mechanical Engineering)
Autonomous Batch starting from A.Y. 2018-19

INSTRUMENTATION & CONTROL SYSTEMS			
Subject Code	18MEMET7020	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	48	Exam Hours	03
Credits - 03			

Course Objectives:

1. To provide basic knowledge of measurement techniques and study the different errors measuring from the instruments.
2. To provide basic knowledge of displacement measuring instruments.
3. To learn about various temperature and pressure measuring instruments.
4. To describe various instruments used to measure level, flow, speed, acceleration& vibrations.
5. To Identify and calculate methods of stress and strains in measurements and various instruments to measure humidity, force, torque and power.
6. To categorize the importance of control systems in instruments

Unit -1	**Teaching Hours**
Definition–Basic principles of measurement – measurement systems, generalized configuration and functional Descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error,classification and elimination of error.	**Hours – 10**
Unit -2	
Measurement of Displacement: Theory and construction of various transducers to measure displacement – piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers, calibration procedures. **Measurement of Temperature:** Classification – ranges – various principles of measurement – expansion, electrical resistance – thermistor – thermocouple – pyrometers – temperature indicators. **Measurement of Pressure:** Units – classification – different principles used. Manometers, piston, bourdon pressure gauges, bellows-diaphragm gauges. low pressure measurement – thermal conductivity gauges – Ionization pressure gauges, Mcleod pressure gauge.	**Hours – 8**
Unit - 3	
Measurement of Level: Direct method – indirect methods- capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – bubbler level indicators. **Flow Measurement:** Rotameter, magnetic, ultrasonic, turbine flow meter, hot – wire anemometer, laser Doppler anemometer (LDA). **Measurement of Speed :** Mechanical tachometers – electrical tachometers – stroboscope, noncontact type of tachometer	**Hours – 10**

Measurement of Acceleration and Vibration: Different simple instruments – principles of seismic instruments – Vibrometer and accelerometer using this principle.	
Unit – 4	
Stress Strain Measurements: Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, strain gauge rosettes. **Measurement of Force, Torque and Power-** Elastic force meters, load cells, torsion meters, Dynamometers.	**Hours – 12**
Unit-5	
Control Systems : Introduction, importance – classification – open and closed systems, Servo mechanisms–examples with block diagrams– temperature, speed & position control systems- Feedback systems-PI, PID control – Programmable Logic Controllers.	**Hours – 10**
Course Outcomes: On completion of this course, students should be able to: 1. Criticize the methods of measurement techniques and describes the errors of the instruments 2. Describe the importance of displacement measuring instruments. 3. Describe and distinguish between the temperature and pressure measuring instruments 4. Demonstrate which is the suitable instrument is required to measure the variables. 5. Subdivide the various types of stress strain measuring gauges and Demonstrate the various performance characteristics of force, torque and power measuring devices 6. Differentiate and importance of open and closed loop control systems in instrument and Demonstrate the various PI, PID controls and programmable logic controls.	
Question paper pattern: **Section A:** 1. This section contains ten one or two line answer questions carrying 1 mark each. 2. Two questions from each unit will be set. **Section B:** 1. This Section will have 05 questions with internal choice. 2. Each full question carries 12 marks. 3. Each full question comprises sub question covering all topics under a unit.	
Text Books: 3. Measurement Systems: Applications & design by D.S Kumar. 4. Mechanical Measurements / BeckWith, Marangoni, Linehard, PHI /PE. 5. Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, Mcgraw-Hill: New Yark, 1999	
Reference Books: 5. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh/ TMH. 6. Experimental methods for Engineers / J. P. Holman / McGraw Hill 7. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers	

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	1	2	2										1		
2	1		3										3		
3	1		3										3		
4	1		2										3		
5	1		2										3		
6	1		2										2		
Overall	1	1	3										3		

Course: Instrumentation & Control Systems

S. No.	Unit Name	Text Book Reference	Page No.
1.	**Basic principles of measurement**	**T1**	3,8,10,52
2.	**Measurement of Displacement**	**T1**	150,165,172,186,188,192,337,340 ,362,370,374,441,458,
		T2	63,65,102
		T3	4.12,4.13,4.28,4.47,4.48,4.51,4.52
		T4	283,291,320,389
		T5	227,228,232,234,236,253,427
		T6	518
3.	**Measurement of Level**	**T1**	384,385,555,557,568,574
		T2	188,203
		T3	4.155,4.159,4.181,4.109,4.113,4.141,4.143
		T4	213,396,237,254,
		T5	118,125,345,
4.	**Stress Strain Measurements**	**T1**	498,500,507,540,591,594,610
		T3	4.54,5.56,4.58,4.61
		T4	298,163,289,268,310
		T6	423,496,700
5.	**Control Systems**	**T1**	644,647,651,653,660
		T3	2.30,2.32.2.33,2.41,2.44,2.26,2.29
		T4	345,281
		T6	797,798,516,681

Text/Reference Books:

T1. Measurement Systems: Applications & design by D.S Kumar.
T2. Mechanical Measurements / BeckWith, Marangoni,Linehard, PHI /PE.
T3. Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, Mcgraw-Hill: New Yark, 1999
T4.Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh/ TMH.

T5. Experimental methods for Engineers / J. P. Holman / McGraw Hill
T6. Mechanical and Industrial Measurements / R.K. Jain/ KhannaPublishers

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IV B.Tech I Semester (Mechanical Engineering)
Autonomous Batch starting from A.Y. 2018-19

Gas Dynamics & Jet Propulsion (ELECTIVE-III)			
Subject Code	18MEMEP7051	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			

Course Objectives:

1. To understand and analyze the basic principle of Gas Dynamics
2. To analyze flow with normal and Oblique shocks
3. To understand about Simple frictional flow: adiabatic flow with friction
4. To Examine the effect of heat transfer on flow parameters , Rankine Hugoniat equations
5. To understand and analyze the basic principle and importance of Jet Propulsion, - thrust equation - effective jet velocity - specific impulse - rocket engine performance.

Unit -1	**Teaching Hours**
Introduction to gas dynamics: control volume and system approaches acoustic waves and sonic velocity - mach number - classification of fluid flow based on mach number - mach cone-compressibility factor - general features of one dimensional flow of a compressible fluid - continuity and momentum equations for a control volume. ***Subsonic and supersonic***	**Hours – 10**
Unit -2	
Isentropic flow of an ideal gas: basic equation - stagnation enthalpy, temperature, pressure and density stagnation, acoustic speed - critical speed of sound- dimensionless velocity-governing equations for isentropic flow of a perfect gas - critical flow area - stream thrust and impulse function. Steady one dimensional isentropic flow with area change-effect of area change on flow parameters- chocking convergent nozzle - performance of a nozzle under decreasing back pressure -De lavel nozzle - optimum area ratio effect of back pressure - nozzle discharge coefficients - nozzle efficiencies, ***oblique shock.***	**Hours – 10**
Unit - 3	
Simple frictional flow: adiabatic flow with friction in a constant area duct-governing equations - fanno line limiting conditions - effect of wall friction on flow properties in an Isothermal flow with friction in a constant area duct-governing equations - limiting conditions. Steady one dimensional flow with heat transfer in constant area ducts- governing equations - Rayleigh line entropy change caused by heat transfer -	**Hours – 10**

conditions of maximum enthalpy and entropy.	
Unit – 4	
Effect of heat transfer on flow parameters: Intersection of Fanno and Rayleigh lines. Shock waves in perfect gasproperties of flow across a normal shock - governing equations - Rankine Hugoniat equations- Prandtl's velocity relationship - converging diverging nozzle flow with shock thickness - shock strength.	**Hours – 10**
Unit-5	
Propulsion: Air craft propulsion: - types of jet engines - energy flow through jet engines, thrust, thrust power and propulsive efficiency turbojet components-diffuser, compressor, combustion chamber, turbines, exhaust systems .Performance of turbo propeller engines, ramjet and pulsejet, scramjet engines. Rocket propulsion - rocket engines, Basic theory of equations - thrust equation - effective jet velocity - specific impulse - rocket engine performance - solid and liquid propellant rockets comparison of various propulsion systems. ***Propellants & feeding systems and combustion, Space flights.***	**Hours – 10**

Course Outcomes:

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

1. Solve flow equations for quasi one dimensional flow through variable area ducts.
2. Analyze the flow through constant area ducts with friction and heat transfer.
3. Analyze flows with normal and oblique shocks.
4. Solve flow problems with supersonic velocities using shock-expansion theory, linearized velocity potential equation for multi-dimensional flows.
5. Analyze the performance of tubro propeller engines, basic theory of equations- thrust, effective jet velocity.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Compressible fluid flow /A. H. Shapiro / Ronald Press Co., 1953
2. Fundamentals of compressible flow with aircraft and rocket propulsion/S. M. Yahya/New Age international Publishers
3. Fundamental of Gas dynamics-2nd edition/ M J Zucker/ Wiley publishers
4. Gas dynamics / M.J. Zucrow & Joe D.Holfman / Krieger Publishers
5. Gas dynamics and Jet propulsion /PR.S.L.Somasundaram/New age international Publisher
6. Thermal Engineering /R.K.Rajput

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	2	1	2	2	2	0	1	1	0	1	3	0	0
2	3	3	3	1	2	2	2	0	2	1	0	1	3	0	0
3	3	3	2	3	3	3	3	0	3	1	0	1	3	0	0

4	3	1	2	3	3	3	1	0	2	1	0	1	3	0	0
5	2	2	0	0	0	0	0	0	0	0	0	0	2	0	0
Over all	3	2	2	2	2	2	2	0	2	1	0	1	3	0	0

Course: Gas Dynamics And Jet Propulsion

S. No.	Unit Name	Text Book Reference	Page No.
1.	**Introduction to gas dynamics**	**T1**	22,23,25,73,78,87,88,92,97,396,485,596
		T2	22,23,83,84
		T3	35,63,64,65,66
		T4	1,12,13
2.	**Isentropic flow of an ideal gas**	**T1**	45,46-51,87,179,180,182,184,186,187,188,190,219
		T3	63
		T4	22,23,24,25,28,37,96
3.	**Simple frictional flow**	**T1**	265,266,267,268,269,270,309,310
		T4	60 to 65,67 to 71,74 to 78,95 to 98
4.	**Effect of heat transfer on flow parameters**	**T1**	320,321,172,180,176
5.	**Propulsion**	**T1**	453,456,460,462,465,470,503,514,555,530
		T4	141,144,145,154 to 155,158 to160
		T5	1393 to 1394,1411 to 1415

Text/Reference Books:

T1. Fundamentals of compressible flow with aircraft and rocket propulsion/S. M. Yahya/New Age international Publishers

T2. Fundamental of Gas dynamics-2nd edition/ M J Zucker/ Wiley publishers

T3. Gas dynamics / M.J. Zucrow & Joe D.Holfman / Krieger Publishers

T4. Gas dynamics and Jet propulsion /PR.S.L.Somasundaram/New age international Publisher

T5. Thermal Engineering /R.K.Rajput

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FINITE ELEMENT METHODS (ELECTIVE-III)			
Subject Code	18MEMEP7052	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Course Objectives:

1. To learn basic principles of finite element analysis procedure .
2. To learn the theory and characteristics of finite elements that represent engineering structures.
3. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses performed by others.
4. Learn to model complex geometry problems and solution techniques.

Unit -1	**Teaching Hours**
Introduction to finite element method, stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, variational and weighted residual methods, concept of potential energy, Formulation of Finite element characteristic matrices and vectors (Element Stiffness Matrix and Load Vectors), Assembly of element stiffness for one dimensional problems.	**Hours – 10**
Unit -2	
Finite Element Formulation: Concept of discretisation, Interpolation, Compatibility, Assembly and boundary considerations. Shape functions for one dimensional quadratic and cubic elements in natural coordinates, treatment of boundary conditions, Temperature effects, node numbering, mesh generation, local and global coordinates, convergence requirements.	**Hours – 10**
Unit - 3	
Analysis of Plane Trusses: Plane Trusses, Local and Global Coordinate systems, Element Stiffness Matrix, Stress Calculations, Example of plane Truss with three members. **Analysis of Beams**: Two nodes beam Element, shape functions, element stiffness matrix and load vectors, simple problems on beams with distributed and point loads.	**Hours – 10**
Unit – 4	
Finite element modeling of two dimensional stress analysis with constant strain triangles, Shape functions of CST element. **Higher Order and Iso Parametric Elements**: Two dimensional four noded isoparametric elements, Lagrangian interpolation functions and Numerical Integration	**Hours – 10**
Unit-5	
Steady State Heat Transfer Analysis one dimensional analysis of a fin and	**Hours – 10**

two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion. **Dynamic Analysis:** Formulation of finite element model, element consistent and lumped mass matrices, evaluation of Eigen values and Eigen vectors, free vibration analysis	

Course Outcomes:

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

1. Identify and formulate different stress and strain relations, displacement relations on a particular object using FEM methods.
2. Apply and solve different element shapes using stiffness matrix
3. Distinguish between the analysis of trusses and beams
4. Analyze a finite element modeling problems of two dimensional stress by constant strain triangles
5. Apply one dimensional quadratic equation on isoparametric elements and numerical integrations.
6. Perform dynamic analysis of finite element models.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Reddy J.N /An Introduction to Finite Element Method, /Tata McGraw Hill.
2. Seshu P /Text Book of Finite Element Analysis,/Prentice Hall.
3. Rao S.S/The Finite Element Method in Engineering, 3rd ed., Butterworth Heinemann,
4. Chandraputla & Belegundu, Introduction to Finite Elements in Engineering/ Prentice Hall

Reference Books:

1. S S Bavakati /Finite Element Analysis/S S Bavakati/ New age Publishers
2. Robert D Cook/ Finite Element Modeling for stress analysis/ John Wiley &Sons, Inc.
3. O C Zienkiewicz and R L Taylor /Finite Element Methods/Butterworth Heinemann

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
1	2	3	1	0	0	0	0	0	0	0	0	0	0	1	2
2	2	3	0	0	0	0	0	0	0	0	0	0	0	2	2
3	2	3	1	1	0	0	0	0	0	0	0	0	0	1	2
4	2	3	1	1	0	0	0	0	0	0	0	0	0	2	2
5	2	3	1	1	0	0	0	0	0	0	0	0	0	1	2
6	2	3	1	1	0	0	0	0	0	0	0	0	0	1	2
Over all	2	3	2	1	0	0	0	0	0	0	0	0	0	2	2

Course: Finite Element Method

S. No.	Unit Name	Text Book Reference	Page No.
1.	**Introduction to finite element method**	**T1**	1,51,52,607,27&60,28,118,103
		T2	1,16,89,49,56
		T3	3,277,410,281,158,296,28,204
		T4	1,2,4,6,9,45,58
		T5	1,9,13,14,16,128134161165
		T7	1,138,140,93
2.	**Finite Element Formulation**	**T1**	114&125,47,112,113,132,104&453,115,179
		T2	321,95,52,108
		T3	75,211,134,211,281,63,82
		T4	58,48,62,84,47,48
		T5	168,61&68,175,38,41,58
		T7	63
3.	**Analysis of Plane Trusses**	**T1**	194 to 199,233,237,241,256
		T2	111 to 113,117,118,119,123
		T3	311 to 314,319,323,324,325,327
		T4	103,104,106,112,237,240,243,246
		T5	180,40, 183 to 185,242,248
4.	**Finite element modeling of two dimensional**	**T1**	409,141,634,742,348
		T2	149,150,159,158,198
		T3	355,357,357,119,135,130
		T4	130,133,134,134,220&208, 221
		T5	204,204,65,220,82,230
		T7	93,94,101,178,179,198
5.	**Steady State Heat Transfer Analysis**	**T1**	162,458,485,325,325
		T2	57,232,255
		T3	489,615,427,241
		T4	308,320,331,367,367
		T6	205,227

Text/Reference Books:

1. Reddy J.N /An Introduction to Finite Element Method, /Tata McGraw Hill.
2. Seshu P /Text Book of Finite Element Analysis,/Prentice Hall.
3. Rao S.S/The Finite Element Method in Engineering, 3rd ed., Butterworth Heinemann.
4. Chandraputla & Belegundu, Introduction to Finite Elements in Engineering/ Prentice Hall
5. S S Bavakati /Finite Element Analysis/S S Bavakati/ New age Publishers
6. Robert D Cook/ Finite Element Modeling for stress analysis/ John Wiley &Sons, Inc.
7. O C Zienkiewicz and R L Taylor /Finite Element Methods/Butterworth Heinemann

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Ranked as "A" Grade by Govt. of A.P.
Department of Mechanical Engineering

IV B.Tech I Semester (Mechanical Engineering)
Autonomous Batch starting from A.Y. 2018-19

FLEXIBLE MANUFACTURING SYSTEMS (ELECTIVE-III)			
Subject Code	18MEMEP7053	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			

Course Objectives:

1. Learn different types of FMS,
2. Designing and analyzing the same using simulation and different analytical techniques.
3. Helps to learn the tool management in FMS & to handle the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS

Unit -1	**Teaching Hours**
Understanding of FMS: Evolution of Manufacturing Systems, Definition, objective and Need, Components, Merits, Demerits and Applications Flexibility in Pull and Push type	**Hours – 10**
Unit -2	
Classification of FMS Layout: Layouts and their Salient features, Single line, dual line, loop, ladder, robot centre type etc.	**Hours – 09**
Unit - 3	
Processing stations: Salient Features Machining Centers, Turning centre, Coordinate measuring machine (CMM), Washing/ Deburring station	**Hours – 08**
Unit – 4	
Material Handling System: An introduction, Conveyor, Robots, Automated Guided Vehicle (AGV), Automated Storage Retrieval System (ASRS) Management technology: Tool Management, tool magazine, Tool preset, identification, Tool monitoring and fault detection, routing, Production Planning and Control, Scheduling and loading of FMS	**Hours – 12**
Unit-5	
Design of FMS: Performance Evaluation of FMS, Analytical model and Simulation model of FMS Case studies: Typical FMS problems from research papers	**Hours – 11**

COURSE OUTCOMES:

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

1. Identify and distinguish FMS with other manufacturing systems including job-shop and mass production systems.
2. Explain processing stations and material handling system used in FMS environments.

3. Design and analyze FMS using simulation and analytical techniques.
4. Understand tool management in FMS.
5. Analyze the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. William W Luggen, "Flexible Manufacturing Cells and System" Prentice Hall of Inc New Jersey, 1991
2. Reza A Maleki "Flexible Manufacturing system" Prentice Hall of Inc New Jersey, 1991
3. John E Lenz "Flexible Manufacturing" marcel Dekker Inc New York ,1989

Reference Books:

1. Groover, M.P "Automation, Production Systems and Computer Integrated
2. Manufacturing", Prentice HallFlexible Manufacturing Systems/ H K Shivanand/New Age International/2006

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1															
2															
3															
4															
5															
6															
Over all															

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Department of Mechanical Engineering

IV B.Tech I Semester (Mechanical Engineering)
Autonomous Batch starting from A.Y. 2018-19

AUTOMOBILE ENGINEERING (ELECTIVE-IV)			
Subject Code	18MEMEP7061	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			

COURSE OBJECTIVES:
The course imparts the principles of automobile systems and provides the salient features of safety, emission and service of automobiles.

Unit -1	**Teaching Hours**
Components of four wheeler automobile – chassis and body – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, electronic injection for SI and CI engines, unit injector system, common rail direct injection system, turbo charging and super charging –splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation, reboring.	**Hours – 10**
Unit -2	
Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, constant mesh, synchromesh gear boxes, epicyclic gear box, over drive torque converter, limited slip differential. propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.	**Hours – 10**
Unit – 3	
Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.	**Hours – 08**
Unit – 4	
Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system. **Braking System:** Mechanical brake system, hydraulic brake system, master cylinder, wheel cylinder tandem master cylinder requirement of brake fluid, pneumatic and vacuum brakes, and traction control. **Electrical System:** Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc, ECU.	**Hours – 12**
Unit-5	
Safety Systems : Safety: Introduction, safety systems - seat belt, air bags, bumper, anti lock brake system (ABS), suspension sensors, traction control,	**Hours – 10**

and speed control, cruise control. **Engine Emission Control**: Types of pollutants, mechanism of formation, Exhaust gas treatment-thermal and catalytic converters-use of alternative fuels for emission control, Emission norms (Euro & BS).	

Course Outcomes:

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

1. Understand the basic lay-out of an automobile.
2. Understand the operation of engine cooling, lubrication, ignition, electrical and air conditioning systems.
3. Understand the principles of transmission, suspension, steering and braking systems.
4. Understand automotive restraint system.
5. Study latest developments in automobiles.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2 / Kirpal Singh/standard publishers
2. Automobile Engineering by R K Rajput
3. Automotive mechanics by William H Crouse

Reference Books:

1. Automobile Engineering / C Srinivasan/McGrawHill
2. Automobile Engineering/P.S Gill/S.K. Kataria & Sons/New Delhi.

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	2	0	2	3	3	0	0	0	0	0	0	0	2	2	0
2	3	3	2	3	3	0	0	0	0	0	0	0	2	2	0
3	3	2	3	2	3	0	0	0	0	0	0	0	2	2	0
4	2	3	3	3	3	0	0	0	0	0	0	0	2	2	0
5	2	3	3	3	3	0	0	0	0	0	0	0	2	2	0
Over all	3	2	0			0	0	0	0	0	0	0			0

Course: Automobile Engineering

S. No.	Unit Name	Text Book Reference	Page No.
1.	**Components of four wheeler automobile**	**T1**	14-16,21-23,1-5,5-10,27-31,32-37
		T2	10-23,284-286,188-195,187
		T3	2-22,138,125,224,210,303,310
2.	**Clutches, principle**	**T1**	28-29,33-46,49-51,74-81,114-117,130,158-160,154-156,306-308
		T3	536,541-546,549-552,554-557
3.	**Steering geometry**	**T1**	209,210-212,212-214,216-227,230-231
		T3	675,682,675-683,675-678,685
4.	**Suspension System**	**T1**	168,176-178,184-186,324,328-337,339-345,415-428,412-414
		T2	433,453-459,250-254
		T3	658,673-674,686,713,722,733-734,354
5.	**Safety Systems**	**T1**	445,471-473,475
		T2	380,466,479,521,523

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2 / Kirpal Singh/standard publishers
2. Automobile Engineering by R K Rajput
3. Automotive mechanics by William H Crouse

Reference Books:

1. Automobile Engineering / C Srinivasan/McGrawHill
2. Automobile Engineering/P.S Gill/S.K. Kataria & Sons/New Delhi.

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IV B.Tech I Semester (Mechanical Engineering)
Autonomous Batch starting from A.Y. 2018-19

MECHATRONICS (ELECTIVE-IV)			
Subject Code	18MEMEP7062	IA Marks	30
Number of Lecture Hours/Week	3(L)+1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			

Course Objectives:

1. To describe the different components and devices of mechatronics systems
2. To understand the concept of Solid-state electronic devices
3. Tounderstand the structure of microprocessors and their applications in mechanical devices
4. To understand the principle of automatic control and real time motion control systems, with the help of electrical drives and actuators
5. To understand the use of micro-sensors and their applications in various fields

Unit -1	**Teaching Hours**
Mechatronics systems – elements & levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers: classification-displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors	**Hours – 10**
Unit -2	
Solid state electronic devices - PN junction diode, BJT, FET, DIAC, TRIAC and LEDs. Analog signal conditioning, operational amplifiers, noise reduction, filtering.	**Hours – 8**
Unit - 3	
Hydraulic and pneumatic actuating systems - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electropneumatic, hydro-pneumatic, electro-hydraulic servo systems. Mechanical actuating systems and electrical actuating systems – basic principles and elements.	**Hours – 10**
Unit – 4	
Digital electronics and systems, digital logic control, microprocessors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control. Dynamic models and analogies, System response. Process Controllers – Digital Controllers, Programmable Logic Controllers, Design of mechatronics systems & future trends.	**Hours – 12**
Unit-5	
Micro mechatronic systems: Microsensors, Micro actuators; Micro-	**Hours – 10**

fabrication techniques LIGA Process: Lithography, etching, Micro-joining etc. Application examples; Case studies Examples of Mechatronic Systems from Robotics Manufacturing, Machine Diagnostics, Road vehicles and Medical Technology.	

Course Outcomes:

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

1. Model, analyze and control engineering systems.
2. Identify sensors, transducers and actuators to monitor and control the behavior of a process or product.
3. Identify Hydraulic and pneumatic actuating systems.
4. Evaluate the performance of mechatronic systems.
5. Applythe use of micro-mechatronic systems in various fields& case studies.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Mechatronics System Design / Devdasshetty/Richard/Thomson.

Reference Books:

1. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition, Pearson, 2012 W. Bolton.
2. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
3. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
4. Mechatronics – Smaili A, Mrad F, Oxford Higher Education, Oxford University Press.
5. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
6. Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlsevier, Indian print

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	3	1	2				2			1			
2	1	1		3	1				2		1	1			
3		1	1	3	1										
4	3	2	2	2	3		1	2	2			1			
5	1	1	1	3	1										
Over all	4	5	4	5	5	0	1	1	3	0	1	3	0	0	0

Course: Mechatronics

S. No.	Unit Name	Text Book Reference	Page No.
1.	Mechatronics systems	**T1**	5,24,31,110,122,161,169,181
		T2	17,18,19,30,33,38,49,53,56,58
		T3	1.1,2.1,2.5,2.17,2.18,2.21
		T5	1,264,5,185
		T6	3
2.	Solid state electronic devices	**T2**	179,184,458,457,70,76,80,91
		T5	86
		T6	18,23,35,91,22,240,257,67
		T2	138,140,143,157,177,179
		T3	6.1,6.6,5.1,7.1
		T5	152,159,160
		T6	401,396,
		T2	359,391,150,460,514,463,238, 311
		T3	4.1,11.1,11.10,11.5,13.1,13.2
		T5	94,95,141
		T6	140,345
		T1	382,411
3.	Micro mechatronic systems	**T2**	546
		T5	207,172,227,295
		T6	414,408 to 414,446

Text/Reference Books:

T1. Mechatronics System Design / Devdasshetty/Richard/Thomson.
T2. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition, Pearson, 2012 W. Bolton.
T3. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
T4. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
T5. Mechatronics – Smaili A, Mrad F, Oxford Higher Education, Oxford University Press.
T6. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
T7. Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlsevier, Indian print
T8. Mechatronics – HMT Ltd., Tata McGraw-Hill publishing Company Ltd.

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Department of Mechanical Engineering

IV B.Tech II Semester (Mechanical Engineering)
Autonomous Batch starting from A.Y. 2018-19

AUTOMATION IN MANUFACTURING			
Subject Code	18MEMET8010	IA Marks	30
Number of Lecture Hours/Week	3(L)+0(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			

Course Objectives:

1. Describe the basic concepts of CAD,CAM, CIM and Automation process
2. Acquire the fundamental concepts of automated flow lines and their analysis.
3. Apply the line balancing methods and improve the assembly process.
4. Classify automated material handling, automated storage and retrieval systems.
5. Illustrate adaptive control systems and automated inspection methods.

Unit -1	**Teaching Hours**
Introduction to CAD/CAM, CIM, Automation its Types and strategies, pneumatic and hydraulic components-case studies and circuits, control system and its types, automation in machine tools, mechanical feeding and tool changing and machine tool control.	**Hours – 8**
Unit -2	
Automated Flow Lines: Methods of part transport, transfer mechanism, buffer storage, control function, design and fabrication considerations. **Analysis of Automated Flow Lines** - General terminology and analysis of transfer lines without and with buffer storage, partial automation, Implementation of automated flow lines.	**Hours – 12**
Unit - 3	
Assembly System and Line Balancing: Assembly process and systems, assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.	**Hours – 08**
Unit – 4	
Automated Material Handling and Storage Systems: Types of equipment, functions, analysis and design of material handling systems, conveyor systems, and automated guided vehicle systems. Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.	**Hours – 12**
Unit-5	
Adaptive Control Systems: Introduction, adaptive control with optimization, adaptive control with constraints, application of adaptive control in machining operations. Consideration of various parameters such as cutting force, temperatures and toque in the adaptive controls systems. **Automated Inspection:** Fundamentals, types of inspection methods and	**Hours – 10**

equipment, Coordinate Measuring Machines, Machine Vision.	

Course Outcomes:

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

1. Illustrate the basic concepts of automation in machine tools.
2. Analyze various automated flow lines.
3. Explain assembly systems and line balancing methods.
4. Describe the importance of automated material handling and storage systems.
5. Interpret the importance of adaptive control systems, automated inspection systems.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Automation, Production Systems, and Computer-integrated Manufacturing, Mikell P. Groover, prentice Hall
2. Computer control of manufacturing system, 1st edition, Yoram Koren

Reference Books:

1. CAD / CAM/ CIM by Radha krishnan
2. Manufacturing – Engineering and Technology, SeropeKalpakjian and Steven R. Schmid 7th edition, Pearson
3. Flexible Manufacturing Systems by H.K.Shivanand, New Age International publisher
4. Industrial Robotics by Mikell P. Groover, Tata McGraw-Hill Education.
5. Assembly Automation: A Management Handbook, Frank J. Riley

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	0	0	0	0	2	1	0	0	1	0	0	0	2	0	0
2	0	0	1	0	2	1	0	0	1	0	0	0	1	0	0
3	0	0	0	0	2	1	0	0	1	0	0	1	2	0	0
4	0	0	0	0	2	1	0	0	1	0	0	1	2	0	0
5	0	0	0	0	2	1	0	0	1	0	0	1	1	0	0
6	0	0	0	0	2	1	0	0	1	0	0	1	2	0	0
Over all	0	0	1	0	3	2	0	0	2	0	0	2	2	0	0

Course: Automation In Manufacturing

S. No.	Unit Name	Text Book Reference	Page No.
11.	Introduction to CAD	T1	9,15,77,387,389,484
		T3	519
		T4	1043,1054,1089
		T6	3,4,35,72,73,147
		T7	106
12.	Automated Flow Lines Analysis of Automated Flow Lines	T1	448-498
		T6	313
13.	Assembly System and Line Balancing	T1	372, 404-422
14.	Automated Material Handling and Storage Systems	T1	273-289, 314-327
		T4	1061,1062
		T5	61-71
15.	Adaptive Control Systems Automated Inspection	T1	94, 658-682
		T2	193-199
		T3	508-515
		T4	1058,1059.1117
		T5	52,54
		T6	160

Text/Reference Books:

T1. Automation, Production Systems, and Computer-integrated Manufacturing, Mikell P. Groover, prentice Hall
T2. Computer control of manufacturing system, 1st edition, Yoram Koren
T3. CAD / CAM/ CIM by Radha krishnan
T4. Manufacturing – Engineering and Technology, SeropeKalpakjian and Steven R. Schmid 7th edition, Pearson
T5. Flexible Manufacturing Systems by H.K.Shivanand, New Age International publisher
T6. Industrial Robotics by Mikell P. Groover, Tata McGraw-Hill Education.
T7. Assembly Automation: A Management Handbook, Frank J. Riley

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IV B.Tech II Semester (Mechanical Engineering)
Autonomous Batch starting from A.Y. 2018-19

ENERGY CONSERVATION AND MANAGEMENT (ELECTIVE-V)			
Subject Code	18MEMEP8031	IA Marks	30
Number of Lecture Hours/Week	3(L)+0(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 3			

Course Objectives:

1. Understand and analyse the importance of effective energy management
2. Carryout energy accounting and balancing
3. Conduct effective energy audits and suggest methods for energy savings
4. Identify and improve the efficiency of electric system operations

Unit -1	**Teaching Hours**
Introduction to Energy scenario & Basic Concepts: Introduction to energy & power scenario of world, National Energy consumption data, environmental aspects associated with energy utilization; Energy Auditing- need, types, methodology and barriers, role of energy managers, instruments of energy auditing	**Hours – 10**
Unit -2	
Electrical Systems: Components of EB billing, HT and LT supply, transformers, cable sizing; Concept of capacitors, power factor improvement, harmonics; Electric motors- motor efficiency computation, energy efficient motors; Illumination- Lux, Lumens, types of lighting, efficacy, LED lighting and scope of energy conservation in lighting.	**Hours – 12**
Unit - 3	
Thermal systems : Boilers, Furnaces and Thermic Fluid heaters- efficiency computation and energy conservation measures; Steam distribution and usage, steam traps, condensate recovery, flash steam utilization; Insulation & Refractories,Cogeneration - concept	**Hours – 12**
Unit – 4	
Energy conservation in major utilities: pumps, fans, blowers, compressed air systems, Refrigeration& Air Conditioning systems, Cooling Towers, DG sets.	**Hours – 08**
Unit-5	
Energy Economics- Discount period, payback period, internal rate of return, net present value; Life Cycle costing- ESCO concept.	**Hours – 08**

Course Outcomes:

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

1. Understand the World Energy scenario
2. Explain the importance of effective energy conservation and management
3. Implement various energy management programs in commercial and industrial areas.
4. Identify cost effective solutions to various existing energy systems

5. Assess electric bills for cost saving
6. Understand the working principle of few important basic thermal systems

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Witte L.C., Schmidt P.S. and Brown D.R., Industrial Energy Management and Utilization, Hemisphere Publ., Washington, 1988.
2. Callaghn P.W., Design and Management for Energy Conservation, Pergamon Press, Oxford, 1981.
3. Energy Manager Training Manual , Bureau of Energy Efficiency (BEE) under Ministry of Power, GOI, 2004 (available at www.energymanager training.com)

Reference Books:

1. Murphy W.R. and McKay G., Energy Management, Butterworths, London, 1987.
2. Dryden. I.G.C., "The Efficient Use of Energy" Butterworths, London, 1982.
3. Turner. W.C., "Energy Management Hand book", Wiley, New York, 1982.
4. Alan P. Rossiter, Beth P. Jones, and Beth P Jones "Energy Management and Efficiency for the Process Industries", American Institute of Chemical Engineers,2015.
5. Barney L. Capehart, Wayne Turner, and William J. Kennedy "Guide to Energy Management" The Fairmont Press, Inc, 2011.
6. Joshi "Residential, Commercial and Industrial Electrical Systems volume 1" Tata McGraw-Hill,2007.

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	1	1	0	0	0	3	3	0	0	3	0	3	0	0	0
2	3	1	1	3	0	3	3	0	0	0	0	3	0	0	0
3	3	1	1	2	0	3	3	0	0	0	0	3	0	0	0
4	3	3	3	3	0	1	3	0	0	0	0	3	0	0	0
5	3	3	3	3	0	1	3	0	0	0	0	3	0	0	0
6	2	2	2	2	0	0	3	0	0	0	0	3	3	0	0
Over all	3	2	2	3	0	3	3	0	0	1	0	3	1	0	0

Course: ENERGY CONSERVATION AND MANAGEMENT

S. No.	Unit Name	Text Book Reference	Page No.
1.	**Introduction to Energy scenario & Basic Concepts**	T3	2,3
		T4	1,136
		T5	484,584
		T6	2,23,33
		T7	3,81
		T8	1,61,461
2.	**Electrical Systems**	T7	290
		T8	87,173
		T9	114,179,251,307,443,464,468
3.	**Thermal systems**	T4	11,123
		T5	200,394
		T6	87,139,147,155,437
		T7	107,164,207
		T8	283,313,389
4.	**Energy conservation in major utilities**	T6	269
		T7	186,260,277
		T8	245
		T9	396
5.	**Energy Economics**	T3	33,36
		T4	3,6,8
		T6	46,58
		T8	131

Text/Reference Books:

Text Books:

T1. Witte L.C., Schmidt P.S. and Brown D.R., Industrial Energy Management and Utilization, Hemisphere Publ., Washington, 1988.

T2. Callaghn P.W., Design and Management for Energy Conservation, Pergamon Press, Oxford, 1981.

T3. Energy Manager Training Manual , Bureau of Energy Efficiency (BEE) under Ministry of Power, GOI, 2004 (available at www.energymanager training.com)

T4. Murphy W.R. and McKay G., Energy Management, Butterworths, London, 1987.

T5. Dryden. I.G.C., "The Efficient Use of Energy" Butterworths, London, 1982.

T6. Turner. W.C., "Energy Management Hand book", Wiley, New York, 1982.

T7. Alan P. Rossiter, Beth P. Jones, and Beth P Jones "Energy Management and Efficiency for the Process Industries", American Institute of Chemical Engineers,2015.

T8. Barney L. Capehart, Wayne Turner, and William J. Kennedy "Guide to Energy Management" The Fairmont Press, Inc, 2011.

T9. Joshi "Residential, Commercial and Industrial Electrical Systems volume 1" Tata McGraw-Hill,2007.

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Department of Mechanical Engineering

IV B.Tech II Semester (Mechanical Engineering)
Autonomous Batch starting from A.Y. 2018-19

NON-DESTRUCTIVE EVALUATION (ELECTIVE-V)			
Subject Code	18MEMEP8032	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Course Objectives:

1. To learn basic principles of these methods and to be able to select a testing process.
2. To expose the concepts of various NDE techniques like radiographic testing, ultrasonic testing, liquid penetrant testing, magneticparticles testing and eddy current testing.
3. To understand the advantages and disadvantages of thesetechniques.

Unit -1	**Teaching Hours**
Introduction:Introduction to non-destructive testing, Visual testing. **Liquid Penetrant Testing:** Basic Concepts, Liquid Penetrant System, Test Procedure, LPT Equipment, Standardization and Calibration, Interpretation and Evaluation, Advantages, Effectiveness, Limitations and applications of Liquid Penetrant Testing.	**Hours – 10**
Unit -2	
UltrasonicTesting: Basic Principles, Ultrasonic Equipment and Variables affecting Ultrasonic Test, Ultrasonic Techniques, Standardization and Calibration, Interpretation and Guidelines for Acceptance, Rejection - Advantages, Effectiveness and Limitations of Ultrasonic Testing, Industrial Applications.	**Hours – 10**
Unit - 3	
Magnetic Particle Testing: Basic Principles of Magnetic Particle Testing, Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, advantages, and limitations of the Magnetic Particle Test, Industrial Applications.	**Hours – 10**
Unit – 4	
Radiographic Testing: Basic Principles of Radiographic test, Sources of X and Gamma Rays, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography, Advantages, Effectiveness and Limitations of Radiographic Testing, Industrial Applications.	**Hours – 12**
Unit-5	
Eddy Current Testing: Principles of Eddy Current testing, Eddy Current Test System, Test Procedure, Applications of Eddy Current Testing, Effectiveness of Eddy Current Testing, Advantages and Limitations of Eddy Current Testing, Industrial Applications.	**Hours – 8**
Course Outcomes:	

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

1. understand the techniques of non-destructive testing.
2. Apply methods of non-destructive testing to evaluateproducts of railways, automobiles, aircrafts, chemical industries, etc.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Non-destructive Test and Evaluation of Materials by J Prasad, CGK Nair, TMH Publishers.
2. Non-Destructive Testing by Dr. S.Ramachandran, Airwalk Publications.
3. Non-Destructive Testing Techniques by Ravi Prakash, New Age International Private Limited.

Reference Books:

1. Non Destructive Testing of Materials by V. Jayakumar, Lakshmi Publications.
2. Basics of Non-Destructive Testing by Lari& Kumar, S.K.Kataria& Sons Publishers.
3. Ultrasonic Inspection Training for NDT: E. A. Gingel, Prometheus Press.
4. ASTM Standards, Vol 3.01, Metals and alloys.

COs vs POs Mapping (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	0	0	0	0	0	0	0	0	0	0	2	0
2	2	2	0	0	0	0	0	0	0	0	0	0	2	0
3	2	2	0	0	0	0	0	0	0	0	0	0	2	0
4	3	2	0	0	0	0	0	0	0	0	0	0	1	0
5	3	2	0	0	0	0	0	0	0	0	0	0	1	0
6	3	2	0	0	0	0	0	0	0	0	0	0	1	0
Over all	3	2	0	0	0	0	0	0	0	0	0	0	3	0

Course: NON-DESTRUCTIVE EVALUATION

S. No.	Unit Name	Text Book Reference	Page No.
1.	Introduction Liquid Penetrant Testing	T1	12,108,111-117
2.	UltrasonicTesting	T1	65,79,84,93,100-107
3.	Magnetic Particle Testing	T1	119-130
4.	Radiographic Testing	T1	12,21,41,50,59
5.	Eddy Current Testing	T1	134,140,145,146

Text/Reference Books:

T1. Non-destructive test and evaluation of Materials by J Prasad, GCK Nair, TMH Publishers.
T2. Non - Destructive Testing by Dr. S.Ramachandran, Airwalk Publications.
T3. Non-Destructive Testing Techniques by Ravi Prakash, New Age International Private Limited.
T4. Non-destructive testing, Warress, JMcGonmade.
R1. Non Destructive Testing of Materials by V. Jayakumar, Lakshmi Publications.
R2. Basics of Non-Destructive Testing by Lari& Kumar, S.K.Kataria& Sons Publishers.
R3. Ultrasonic Inspection Training for NDT: E. A. Gingel, Prometheus Press.
R4. ASTM Standards, Vol 3.01, Metals and alloys.
R5. Non-destructive, Hand Book – R. Hamchand.

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Department of Mechanical Engineering

IV B.Tech II Semester (Mechanical Engineering)
Autonomous Batch starting from A.Y. 2018-19

SOLID MECHANICS (ELECTIVE-V)			
Subject Code	18MEMEP8033	IA Marks	30
Number of Lecture Hours/Week	3(L)+1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Course Objectives:

1. To learn the method of calculating stress and strain in a member subjected to principal stress and strain and relation between them.
2. To understand the relation between elastic constants and material symmetry.
3. To analyze the theories of failures and bending of beams.
4. To calculate the torsion of a circular, elliptical, triangular, rectangular bars, and Rolled sections.
5. To calculate the stress energy stored by using different energy methods.

Unit -1	**Teaching Hours**
Stress: derivation of Cauchy relations and equilibrium and symmetry equations, principal stresses and directions. **Strains:** concept of strain. Derivation of small strain tensor and compatibility. strain theory, principal strains, strain of a volume element, small displacement theory Stress-strain relations for isotropic materials	**Hours – 10**
Unit -2	
Constitutive Equations: Generalized Hooke's law, linear elasticity, Material symmetry: Boundary value Problems: Principal planes, cubic equations, The state of stress referred to principal axes Plane stress and plane strain problems	**Hours – 10**
Unit - 3	
Theories of Failure: Significance of the theories of failure, Factor of safety in design, Ideally plastic solid **Bending of Beams**: Straight beams and asymmetrical bending, Bending of curved beams	**Hours – 10**
Unit – 4	
Torsion & Axisymmetric Problems: Torsional of general prismatic bars-solid sections, Torsion of circular, elliptical, triangular and rectangular bars, Torsional of Rolled sections, Thick walled cylinder subjected to internal and external pressures -lames-problems, Stresses in composite tubes, Thermal Stresses.	**Hours – 8**
Unit-5	
Energy Methods Solutions using potentials, Energy methods, Work done by forces and elastic strain energy stored, Maxwell-Betti-Rayleigh Reciprocal	**Hours – 12**

theorem, Begg'sDeformeter, First theorem of Castigliano, Theorem of virtual work, Kirchhoff's theorem.	

Course Outcomes:

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

1. To learn the method of calculating stress and strain in a member subjected to principal stress and strain and relation between them.
2. To understand the relation between elastic constants and material symmetry.
3. To analyze the theories of failures and bending of beams.
4. To calculate the torsion of a circular, elliptical, triangular, rectangular bars, and Rolled sections.
5. To calculate the stress energy stored by using different energy methods.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Advanced Mechanics of materials by Boresi& Sidebottom-Wiely International
2. L.S. Srinath, Advanced Mechanics of Solids, 3rd Edition,TMH, 2009.

Reference Books:

1. Advanced strength of materials by Den Hortog J.P.
2. Theory of plates – Timoshenko.
3. Strength of materials & Theory of structures (Vol I & II) by B.C Punmia
4. Strength of materials by Sadhu singh

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1
2	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1
3	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1
4	0	1	0	0	1	1	0	0	0	0	0	0	0	0	1
5	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1
Over all	2	3	1	1	1	1	0	0	0	0	0	0	0	0	3

Course: Solid Mechanics

S. No.	Unit Name	Text Book Reference	Page No.
1.	Stress Strain	T1	14,34,63,78,86,90,98
		T2	28,47,67,219
2.	Constitutive Equations	T1	17,24,42,97
		T2	167,171,176
3.	Theories of Failure Bending of Beams	T1	110,121,132,190,209
		T2	404
4.	Torsion & Axisymmetric Problems	T1	232,240,256,280,310
		T2	513,520
5.	Energy Methods	T1	144-169
		T2	658-678

Text/Reference Books:

1. Advanced Mechanics of Solids, L.S Srinath
2. Introduction to Solid Mechanics, Irving H. Shames, James M. Pitarresh.
3. Advanced strength of materials by Den Hortog J.P.
4. Strength of materials & Theory of structures (Vol I & II) by B.C Punmia
5. Strength of materials by Sadhu singh

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Department of Mechanical Engineering

IV B.Tech II Semester (Mechanical Engineering)
Autonomous Batch starting from A.Y. 2018-19

REFRIGERATION & AIR CONDITIONING (ELECTIVE-VI)			
Subject Code	18MEMEP8041	IA Marks	30
Number of Lecture Hours/Week	3(L)+1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			

Course Objectives:

1. To impart the basic concepts of Refrigeration and Air Conditioning
2. To develop a sound physical understanding of the subject so that the learner will demonstrate the ability to design a refrigeration or air-conditioning equipment that meets the required specifications
3. Comparative study of different refrigerants with respect to properties, applications and Environmental issues
4. Understand the basic air conditioning processes on psychometric charts
5. calculate cooling load for its applications in comfort and industrial air conditioning
6. Study of the various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems

Unit -1	**Teaching Hours**
Introduction to Refrigeration: Necessity and applications – unit of refrigeration and C.O.P., ASHRAE Nomenclature, Mechanical refrigeration – types of ideal cycles of refrigeration, **Air Refrigeration**: Air Refrigeration Cycles-reversed Carnot cycle, Bell-Coleman cycle analysis, Air Refrigeration systems-merits and demerits – refrigeration systems used in air crafts and problems.	**Hours – 10**
Unit -2	
Vapour Compression Refrigeration (VCR): Working principle and essential components of the plant, Simple vapour compression refrigeration cycle – COP – representation of cycle on T-S and p-h charts, effect of sub cooling and super heating – cycle analysis actual cycle influence of various parameters on system performance – use of p-h charts – numerical problems. **VCR System Components:**Compressors, Condensers, Evaporators Expansion devices – classification – working principles	**Hours – 8**
Unit - 3	
Refrigerants – Desirable properties – classification - refrigerants used – nomenclature – ozone depletion –global warming **Vapour Absorption Systems**: Other types of Refrigeration systems – Vapour Absorption Refrigeration Systems, Absorbent – Refrigerant combinations, Water-Ammonia Systems, Water-Lithium Bromide System, Contrast between the two systems, Modified Version of Aqua-Ammonia System with Rectifier and Analyser Assembly	**Hours – 10**

Unit – 4	
Psychrometry: Introduction to Air-Conditioning, Basic Definition, Classification, ASHRAE Nomenclature pertaining to Air-Conditioning, Applications of Air-Conditioning, Psychrometry – Air-water vapour mixtures, Psychrometric Properties, Psychometric or Air-Conditioning processes, Psychrometric Chart. Requirements of human comfort and concept of effective temperature-comfort chart –comfort air conditioning –requirements of industrial air conditioning, air conditioning load calculations.	**Hours – 12**
Unit-5	
Load calculations, need for ventilation and consideration of infiltrated air – Concepts of RSHF, GSHF & ERSHF- problems, ADP temperature. Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers. heat pump – heat sources – different heat pump circuits.	**Hours – 10**

Course Outcomes:

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

1. Resolve the forces into components, moment of force and its applications
2. Construct free body diagrams and develop appropriate equilibrium equations.
3. Determine centroid and moment of inertia for composite areas.
4. Determine the kinematic relations of particles & rigid bodies.
5. Apply equations of motion to particle and rigid body.
6. Analyze motion of particles & rigid bodies using the principle of energy and momentum methods.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. A Course in Refrigeration and Air conditioning / SC Arora &Domkundwar / Dhanpatrai
2. Refrigeration and Air Conditioning / CP Arora / TMH.

Reference Books:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age.
2. Principles of Refrigeration /Dossat / Pearson Education.
3. Refrigeration and Air-conditioning, Stoecker W.F., and Jones J.W., Mc Graw - Hill, New Delhi
4. Refrigeration and Air-conditioning by r k rajput

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	0	0	0	0	0	0	0	0	0	0	3	0	0
2	3	3	0	0	0	0	0	0	0	0	0	0	3	0	0
3	3	3	0	0	0	0	0	0	0	0	0	0	3	0	0
4	3	3	0	0	0	0	0	0	0	0	0	0	3	0	0
5	3	3	0	0	0	0	0	0	0	0	0	0	3	0	0
6	3	3	0	0	0	0	0	0	0	0	0	0	3	0	0
Overall	3	3	0	0	0	0	0	0	0	0	0	0	3	0	0

Course: REFRIGERATION AND AIR CONDITIONING

S. No.	Unit Name	Text Book Reference	Page No.
1.	Introduction to Refrigeration Air Refrigeration	T1	2.1, 2.6,3.2,3.5
		T2	7,72,80,377
		T3	4,12,68,77,83
		T4	7,45,125
2.	Vapour Compression Refrigeration (VCR) VCR System Components	T1	4.1 to 4.16
		T2	89
		T3	113,129,131,133,134,449,450,465,466,467,476,479
		T4	21,108,193,228,352
3.	Refrigerants Vapour Absorption Systems	T1	40.7,6.1,6.2,6.5,6.7,6.13
		T2	128,129,136,138,153,402,406,423,428
		T3	18,21,308,317,325,332,236,239,265
		T4	310
4.	Psychrometry	T1	16.1,16.4,16.10,17.4,17.5,17.7
		T2	474,475,477,452,464,469,518,519,527
		T3	353,361,369,377,378,389
5.	Load calculations	T1	19.20,19.25,20.5,25.4,25.13,25.20,25.13,25.20,
		T2	620,635,638,640,665, 741,747
		T3	383,502,506,576,577,653,592,594,592

Text/Reference Books:

T1. A Course in Refrigeration and Air conditioning / SC Arora &Domkundwar / Dhanpatrai
T2. Refrigeration and Air Conditioning / CP Arora / TMH.
T3. Refrigeration and Air Conditioning / Manohar Prasad / New Age.
T4. Principles of Refrigeration /Dossat / Pearson Education.
T5. Refrigeration and Air-conditioning by R k Rajput
T6. Refrigeration and Air-conditioning, Stoecker W.F., and Jones J.W., Mc Graw - Hill, New Delhi

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Department of Mechanical Engineering

IV B.Tech II Semester (Mechanical Engineering)
Autonomous Batch starting from A.Y. 2018-19

COMPUTATIONAL FLUID DYNAMICS (ELECTIVE-VI)			
Subject Code	18MEMEP8042	IA Marks	30
Number of Lecture Hours/Week	3(L)+0(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Course Objectives:

1. To **gain knowledge** on basics of numerical methods and its applications.
2. To **apply** numerical techniques for solving various engineering problems involving fluid flow and heat transfer.
3. To **solve** governing equations using FDM.
4. To **gain knowledge** about discretization, stability and consistency of the fluid flow and heat transfer equations.
5. To **evaluate** various partial differential equations using various numerical schemes.
6. To **solve** governing equations using FVM.

UNIT -I	**Teaching Hours**
Elementary Details in Numerical Techniques: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, convergence of sequences. **Applied Numerical Methods:** Solution of a system of simultaneous linear algebraic equations, iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for banded matrices.	**Hours – 10**
UNIT -II	
Governing Equations of Fluid Flow and Heat Transfer: Introduction, conservation of mass, Newton'ssecond law of motion, expanded forms of Navier-stokes equations,conservation of energy principle, special forms of the Navier-stokesequations. Steady flow, dimensionless form of momentum and energy equations, stokes equation, conservative body force fields, stream function - vorticity formulation.	**Hours – 10**
UNIT - III	
Finite Difference Method: Finite difference applications in heat transfer – heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, discretization, consistency, stability, and fundamentals of fluid flow modelling, explicit and implicit methods.	**Hours – 10**
UNIT – IV	
Partial Differential Equations: Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modelling, conservative property, the upwind scheme.	**Hours – 10**

UNIT-V

Finite Volume Method: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation. **Hours – 10**

COURSE OUTCOMES:

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

1. **Gain knowledge** on basics of numerical methods and its applications.
2. **Apply** numerical techniques for solving various engineering problems involving fluid flow and heat transfer.
3. **Solve** governing equations using FDM.
4. **Gain knowledge** about discretization, stability and consistency of the fluid flow and heat transfer equations.
5. **Evaluate** various partial differential equations using various numerical schemes.
6. **Solve** governing equations using FVM.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Numerical heat transfer and fluid flow / Suhas V. Patankar- Butter-worth Publishers.
2. Computational fluid dynamics - Basics with applications - John. D. Anderson / Mc Graw Hill.

Reference Books:

1. Computational fluid dynamics – Klaus Hoffman, Steve T.Chiang

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	3	0	0	2	0	0	0	0	0	0	0	0	2	0
2	2	3	0	0	2	0	0	0	0	0	0	0	0	2	0
3	2	3	0	0	2	0	0	0	0	0	0	0	0	2	0
4	2	2	0	0	2	0	0	0	0	0	0	0	0	2	0
5	3	3	0	0	2	0	0	0	0	0	0	0	0	2	0
6	2	3	0	0	2	0	0	0	0	0	0	0	0	2	0
Over all	2	3	0	0	2	0	0	0	0	0	0	0	0	2	0

Course: Computational Fluid Dynamics

S. No.	Unit Name	Text Book Reference	Page No.
1.	Elementary Details in Numerical Techniques Applied Numerical Methods	T1	4-10
		T2	5-23
		R1	11-34
2.	Governing Equations of Fluid Flow and Heat Transfer	T1	12-34
		T2	49-85
		R1	45-87
3.	Finite Difference Method	T1	41-54
		T2	128-145
		R1	112-143
4.	Partial Differential Equations	T1	79-86
		T2	105-117
		R1	154-187
5.	Finite Volume Method	T1	143-153
		T2	123-151
		R1	195-227

Text/Reference Books:

T1. Numerical heat transfer and fluid flow / Suhas V. Patankar- Butter-worth publishers.
T2. Computational fluid dynamics - Basics with applications - John. D. Anderson / Mc Graw Hill
R1. Computational fluid dynamics – Klaus Hoffman, Steve T.Chiang

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Autonomous Batch starting from A.Y. 2018-19

QUALITY & RELIABILITY ENGINEERING (ELECTIVE-VI)			
Subject Code	18MEMEP8043	IA Marks	30
Number of Lecture Hours/Week	3(L)+1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Course Objectives:

1. To provide students with a basic understanding of the approaches and techniques to assess and improve process and/or product quality and reliability.
2. To introduce the principles and techniques of Statistical Quality Control and their practicaluses in product and/or process design and monitoring
3. To understand techniques of sampling plans, design of various sampling plans.
4. To use the tools and techniques of TQM in manufacturing and service sectors.
5. To understand techniques of modern reliability engineering tools.

Unit -1	**Teaching Hours**
Quality value and engineering – quality systems – quality engineering in product design and production process – system design – parameter design – tolerance design, quality costs – quality improvement.	**Hours – 12**
Unit -2	
Statistical process control X , R, p, c charts, other types of control charts, process capability, process capability analysis, process capability index. (SQC tables can be used in the examination).	**Hours – 12**
Unit - 3	
Acceptance sampling by variables and attributes, design of sampling plans, single, double, sequential and continuous sampling plans, design of various sampling plans.	**Hours – 12**
Unit – 4	
TQM tools and techniques, control charts, process capability, concepts of six sigma, Quality Function Development (QFD), Taguchi quality loss function; TPM- concepts, improvement needs, performance measures. Quality information systems, quality circles, introduction to ISO 9000 standards.	**Hours – 12**
Unit-5	
Reliability – Evaluation of design by tests – Hazard Models, Linear, Releigh, Weibull. Failure Data Analysis, reliability prediction based on weibull distribution, Reliability improvement.	**Hours – 12**

Course Outcomes:

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

1. Understand the approaches and techniques and techniques to assess and improve process and/or product quality and reliability

2. Use techniques of Statistical Quality Control and their practicaluses in product and/or process design and monitoring
3. Describe different sampling plans.
4. Acquire basic knowledge of tools and techniques of TQM in manufacturing and service sectors
5. Apply techniques of modern reliability engineering.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. R.C Gupta"Statistical Quality control & Quality management", 9th Ed, khanna publishers
2. E. BalaGuruswamy, 'Reliability Engineering', Tata McGraw Hill.
3. Eugene Grant, Richard Leavenworth "Statistical Process Control", McGraw Hill.

Reference Books:

1. Tirupathi R. Chandrupatla "Quality control &Reliability Engineering", McGraw Hill.
2. J Ross, 'Quality Engineering in Production Systems – McGraw Hill.
3. Jai singhgurjar, 'Reliability Engineering' I K International
4. W.A. Taylor, 'Optimization & Variation Reduction in Quality', Tata McGraw Hill.
5. Quality and Performance Excellence: James R Evans, Cengage learning

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	3	2	0	0	0	0	0	0	0	0	2	0	0	0	0
2	2	2	0	0	0	0	0	0	0	0	2	0	0	0	0
3	2	2	0	0	0	0	0	0	0	0	2	0	0	0	0
4	3	2	0	0	0	0	0	0	0	0	2	0	0	0	0
5	3	2	0	0	0	0	0	0	0	0	2	0	0	0	0
Over all	3	2	0	0	0	0	0	0	0	0	2	0	0	0	0

Course: Quality & Reliability Engineering

S. No.	Unit Name	Text Book Reference	Page No.
6.	Quality value and engineering	T1	810-816
		T2	1
		T3	1-3, 38, 330
7.	Statistical process	T1	115,129,418
		T2	125,129,130,158
8.	Acceptance sampling by variables and attributes	T1	529,530,548,553,559
		T2	195,196,200,201,202
9.	TQM tools and techniques	T1	855-887,909,1024
		T2	158
10.	Reliability	T2	243
		T3	16,56-68,231,252

Text/Reference Books:

T1. R.C Gupta"Statistical Quality control & Quality management", 9th Ed, khanna publishers
T2. Tirupathi R. Chandrupatla "Quality control &Reliability Engineering", Cambridge university press
T3. E. BalaGuruswamy, 'Reliability Engineering', Tata McGraw Hill
T4. Eugene Grant, Richard Leavenworth "Statistical Process Control", McGraw Hill.

sasi INSTITUTE OF TECHNOLOGY & ENGINEERING
autonomous
Accredited by NAAC with "A" Grade
Recognised by UGC under section 2(f) &12(B)
Approved by AICTE - NEW Delhi
Permanently Affiliated to JNTUK, SBTET
Ranked as "A" Grade by Govt. of A.P.
Department of Mechanical Engineering

IV B.Tech II Semester (Mechanical Engineering)
Autonomous Batch starting from A.Y. 2018-19

Project Phase-II			
Subject Code	18MEMER805X	IA Marks	
Number of Lecture Hours/Week	14(L)+0(T)	Exam Marks	
Total Number of Lecture Hours	50	Exam Hours	
Credits - 07			

Objectives:

The aim of the course is to make the student perform a comprehensiveproject work that involves either or all of the following: optimum design of amechanical component or an assembly, thermal analysis, computer aideddesign & analysis, cost effective manufacturing process, material selection,testing procedures or fabrication of components and prepare a detailedtechnical project report file. The student canalso carried out both design and fabrication of a mechanical device whose working can be demonstrated in the previous semester (i.e. seventh semester) and the fabrication and demonstration will be carried out in the eighth semester.The completed task should also take into account thesignificance of real time applications, energy management and theenvironmental affects.

Course content:

The student should work in groups to achieve the aforementioned objectivesand the outcomes.

Course Outcomes:

After completing the project work the student should learn the technical procedure of planning,scheduling and realizing an engineering product andfurther acquire the skills of technical report writing and data collection.

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Ranked as "A" Grade by Govt. of A.P.
Department of Mechanical Engineering

B.Tech (Except Mechanical Engineering)

OPERATIONS RESEARCH (OPEN ELECTIVE)			
Subject Code	18MEXXO505X	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

COURSE OBJECTIVES: Students Should be able to

1. understand linear programming problem formulation, graphical and simplex solutions
2. develop the linear program and dual program.
3. gain knowledge of formulating optimal solution of transportation problem and assignment model.
4. solve the sequencing problems with n-jobs & m-machines. Compute queue performance characteristics for various queuing models.
5. outline game theory and inventory problems by applying standard solution methods
6. use appropriate OR Techniques for solving real world problems.

Unit -1	**Teaching Hours**
Introduction to Operations Research: Definition, Features, types of OR models, Methodology, Tools, Limitations and applications of Linear Programming. **Linear Programming I:** Introduction, Formulation of Linear Programming Problem (LPP), Assumptions for solving LPP, Applications of LPP, Graphical method of solving LPP.	**Hours – 10**
Unit -2	
Linear Programming II: Introduction, steps in solving problems using simplex method, Principle of simplex method- Maximization and minimization problems, solution by simplex method, two phase simplex method, limitations of LPP simplex method. **Linear Programming III:** Introduction, Concept of primal, dual relationship, formulation of the dual of the primal problem, solution of LP problems using dual simplex method.	**Hours – 10**
Unit – 3	
Transportation Problem: Basics, Solution of Transportation problem with several methods, performing optimality test, degeneracy in transportation problem. **Assignment model:** Definition, Formulation, Different methods of solutions, Hungarian assignment method, unbalanced assignment problems, travelling salesman problems.	**Hours – 10**
Unit – 4	
Sequencing problems: introduction, basics, types of sequencing problems, priority sequencing, sequencing n-jobs through two machines, n-jobs and m-machines, two jobs 3-machines case.	**Hours – 10**

QUEUING THEORY: Introduction, Queuing system, Elements of queuing system, Operating characteristics of a queuing system, Classification of queuing models: Model-I [M/M/1:∞ /FIFO], Model-III [M/M/1: N/FIFO].	
Unit-5	
GAME THEORY: Introduction, Two Person Zero Sum games, Maximin - Minimax principle, Games without saddle points- mixed strategies, Graphical solution of 2Xn, mX2 games. Dominance property, P-system, S-system, Q-system and Ss-system **Inventory Management:** introduction, objectives, developing the model, EOQ, Selective inventory management.	**Hours – 10**

COURSE OUTCOMES:

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

1. **Formulate** and solve mathematical model (linear programming problem) for real situations like production and distribution of goods.
2. **Apply** the concept of simplex method and dual simplex algorithm to solve decision-making linear programming problems.
3. Build transportation models and assignment models to carry out sensitivity analysis.
4. **Solve the problems of** competitive business world using Sequencing problem and queuing theory **techniques**.
5. **Identify the inventory and game theory problems in** business world.
6. **Classify optimization problems in real world and apply appropriate OR techniques**

Question paper pattern:

Section A:

1. This section contains 10 one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Operations Research / A.M.Natarajan, P. Balasubramani, A. Tamilarasi / Pearson Education.

Reference Books:

1. Operations Research / S.D.Sharma-KedarnathRamnath(JNTU)
2. Operation Research /J.K.Sharma/MacMilan.
3. Operations Research / R.Pannerselvam / PHI Publications.
4. Operation Research /Premkumar Gupta, D.S.Hira / S.Chand
5. Operation Research An Introduction / Taha / Pearson
6. Operation Research / KanthiSwarup, P.K Gupta, Man Mohan / Sultan Chand & sons

Web Sources:

1. https://onlinecourses.nptel.ac.in/noc18_mg41/preview
2. http://www.cs.toronto.edu/~stacho/public/IEOR4004-notes1.pdf
3. https://drive.google.com/file/d/1wvUeBNBxPVNclTQau9YoGdlh9BT641DN/view
4. https://books.google.co.in/books/about/Operations_Research.html?id=rj6bBMVzfPsC
5. https://www.scribd.com/doc/39100075/Operation-Research-Questions-and-Solutions

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	2	2	0	0	0	0	0	0	2	0	0	2	0	0
2	2	2	0	0	0	0	0	0	2	0	0	2	0	0
3	2	2	2	0	0	0	0	0	2	0	0	2	0	0
4	2	2	0	0	0	0	0	0	2	0	0	2	0	0
5	2	2	2	0	0	0	0	0	0	0	1	2	0	0
6	2	2	2	0	0	0	0	0	0	0	1	2	0	0
Over all	2	2	1	0	0	0	0	0	2	0	1	2	0	0

S.No.	Unit Name	Text Book Reference	Chapter No.
1.	Introduction to Operations Research Linear Programming I	T1	1,2,3
		R1	1,2
		R2	1,2,3
2.	Linear Programming II & III	T1	2,3
		R1	2
		R2	4,5,6
3.	Transportation Problem Assignment model	T1	4
		R1	3,4
		R2	9,10
4.	Sequencing problems Queuing Theory	T1	8,11
		R1	9
		R2	16,19
5.	Game Theory Inventory Management	T1	10
		R1	7,12
		R2	12,14,15

ROBOTICS (OPEN ELECTIVE)			
Subject Code	18MEXXO505X	IA Marks	30
Number of Lecture Hours/Week	3(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Course objectives: The students should be able to:

1. Gain the knowledge of industrial robots and their configurations.
2. Know the components of industrial robots and actuators.
3. Apply spatial transformations to obtain forward and inverse kinematics.
4. Understand the robot dynamics.
5. Generate trajectory planning for path description and generation.
6. Describe the functioning of sensors and the specific applications of robots in industry.

Unit-I	**Teaching Hours**
Introduction: An over view of Robotics, Automation and Robotics, CAD/CAM and Robotics — present and future applications – classification by coordinate system. **Components of the industrial robotics:** Architecture, common types of arms, number of degrees of freedom, end effectors, requirements and challenges of end effectors, Actuators-Pneumatic, Hydraulic actuators, electric & stepper motors.	**Hours-10**
Unit-II	
Motion analysis: Homogeneous transformations as applicable to rotation and translation – problems. **Manipulator kinematics:** Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics problems	**Hours-12**
Unit-III	
Differential transformation and manipulators, Jacobians – problems **Dynamics:** Lagrange – Euler formulations – Problems.	**Hours-08**
Unit-IV	
Trajectory planning: General considerations in path description and generation. Trajectory planning, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages.	**Hours-10**
Unit-V	
Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors. **Robot applications in manufacturing:** Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.	**Hours-10**

Course outcomes:

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

1. Identify various robot configurations and components
2. Select appropriate actuators and sensors for a robot based on specific application.
3. Carry out kinematic and dynamic analysis for simple kinematic chains.
4. Analyze forces in links and joints of a robot.
5. Perform trajectory planning for a robot manipulator.
6. Explain the specific applications of a robot in industry.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Industrial Robotics / Groover M P /Pearson Edu/ McGraw Hill
2. Robotics and Control / Mittal R K & Nagrath I J / TMH
3. Robotics / Fu K S/ McGraw Hill

Reference Books.

1. Robotic Engineering / Richard D. Klafter/ Prentice Hall
2. Introduction of robotics/ John J Craig/ Pearson Edu
3. Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley
4. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.

WEB SOURCE REFERENCES:

1. https://nptel.ac.in/courses/112101098/
2. http://www.robotplatform.com/knowledge/sensors/types_of_robot_sensors.html
3. https://nptel.ac.in/downloads/112103174/

COs VS P Os MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1**):**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	2	1					1					3	2	
2	3	3	3		3		1					2	2	
3	3	3	3		3		1					2	2	
4	3	3	2		2		1					2	2	
5	3	2	2		3		1					3	2	
6	3	3	3		3							2	2	
Overall	3	2	2		2		1					2	2	

S. No.	Unit Name	Text Book Reference	Chapter No.
1.	Introduction& Components of the industrial robotics	T1	1
		T2	1,2&5
		R1	1,2,3& 4
2.	Motion analysis& Manipulator kinematics	T1	2&3
		T2	4
		R1	8
3.	Differential transformation and manipulators & Dynamics	T1	4,5&6
		T2	4
		R1	8
4.	Trajectory planning	T1	7
		T2	8&9
		R1	7
5.	Feedback components& Robot applications in manufacturing	T1	9&10
		T2	6,11&13
		R1	5& 1

Advanced Optimization Techniques (OPEN ELECTIVE)			
Subject Code	18MEXXO505X	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

COURSE OBJECTIVES: Students should be able to

1. build the fundamental concepts of classical optimization techniques
2. gain the knowledge of optimization techniques for solving practical problems in engineering systems
3. learn the Principles of genetic Algorithm
4. solve linear, non linear problems by using optimization techniques
5. determine inventory and queuing problems using Simulation techniques
6. identify the real world optimization problems

Unit -1	**Teaching Hours**
Introduction to Optimization Techniques **Linear Programming:** Introduction and formulation of models, Convexity, Simplex method, Big-M method, Two-phase method, duality in LPP only	**Hours – 10**
Unit -2	
Classical Optimization Techniques: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions, merits and demerits of classical optimization techniques.	**Hours – 10**
Unit – 3	
Numerical Methods For Optimization: Nelder Mead's Simplex search method, Steepest descent method, Newton's method, Pattern search methods, conjugate method, types of penalty methods for handling constraints, advantages of numerical methods.	**Hours – 10**
Unit – 4	
Genetic Algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA, **Genetic Programming (GP):** Principles of genetic programming, terminal sets, functional sets, differences between GA & GP.	**Hours – 12**
Unit-5	
Simulation: Definition – types of simulation models – phases of simulation– applications of simulation –inventory and queuing problems – advantages and disadvantages – simulation languages.	**Hours – 08**

COURSE OUTCOMES:

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

1. Formulate and solve linear Programming Problems
2. Determine the optimum solution to constrained and unconstrained
3. Use Numerical Methods to Optimize the industrial problems
4. Solve various GA problems
5. Determine inventory and queuing problems using Simulation techniques
6. **Identify optimization problems in real world and apply appropriate OR techniques**

Question paper pattern:

Section A:

1. This section contains 10 one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Engineering Optimization – S.S. Rao, New Age Publishers
2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers.

Reference Books:

1. Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers India Ltd.
2. Introduction to Operations Research, Kanti Swarup, Man Mohan and P.K. Gupta, S.Chand & Co., 2006
3. Operations Research-R.Pannerselvam, PHI Publishers.
4. N.S.Kambo: Mathematical Programming Techniques, East-West Pub., Delhi, 1991.

Web Source References:

1. https://nptel.ac.in/courses/Webcourse-contents/IISc BANG/OPTIMIZATION%20METHODS/pdf/Module_1/M1L4slides.pdf
2. https://www.iare.ac.in/sites/default/files/lecture_notes/OT_LECTURE_NOTES_0.pdf

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	3	2	0	0	0	0	0	0	0	2	0	1	0	0
2	3	2	0	0	0	0	0	0	0	2	0	1	0	0
3	3	2	0	0	0	0	0	0	0	2	0	1	0	0
4	3	2	0	0	0	0	0	0	0	2	0	1	0	0
5	3	2	0	0	0	0	0	0	0	2	0	1	0	0
6	3	2	0	0	0	0	0	0	0	2	0	1	0	0
Over all	3	2	0	0	0	0	0	0	0	2	0	1	0	0

S.No.	Unit Name	Text Book Reference	Chapter No.
1	Introduction to Optimization Techniques Linear Programming	T1	1,3.4
		T2	1,6
		R1	1,2
		R3	1,2
2	Classical optimization techniques	T1	2
		T2	3,4
		R1	3
		R3	2,17
3	Numerical methods for optimization	T1	2
		T2	4
		R1	4,5
		R3	2,3,5
4	Genetic algorithm (ga) Genetic programming (gp)	T1	8,12
		T2	5
		R1	6,7
		R3	15
5	Simulation	T1	12
		T2	6
		R1	9
		R3	17

GREEN ENGINEERING SYSTEMS (OPEN ELECTIVE)			
Subject Code	18MEXXO505X	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES: Students should be able to

1. Understand the principles of applications and uses of non conventional energy resources.
2. Learn the basic principles of conversion technologies of non conventional energy
3. resources in to electric power.
4. Acquire concepts of energy efficient systems
5. Gain knowledge of Energy efficient processes
6. Obtain knowledge about features of green buildings

Unit -1	**Teaching Hours**
Introduction to Solar Radiation: Role and potential of new and renewable sources, the solar energy option, solar power, structure of the sun, the solar constant, sun-earth relationships, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine. Photo voltaic energy conversion – types of PV cells, I-V characteristics. **Solar Energy Collection**: Flat plate and concentrating collectors, classification of concentrating collectors. **Solar Energy Storage and Applications**: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney	**Hours – 10**
Unit -2	
Wind Energy: Sources and potentials, horizontal and vertical axis wind mills, performance characteristics, betz criteria, types of winds, wind data measurement. **Bio-Mass**: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C. engine operation and economic aspects. **Geo-Thermal Energy**: Resources, types of wells, methods of harnessing the energy. **Ocean Energy**: OTEC, Principles of utilization, setting of OTEC plants, Tidal and wave energy: conversion techniques, mini-hydel power plants.	**Hours – 10**
Unit – 3	
Energy Efficient Systems: Electrical systems: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives	**Hours – 10**

(adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management. Mechanical systems: Fuel cell principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells	
Unit – 4	
Energy Efficient Processes: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and Joining techniques, zero waste manufacturing	**Hours – 10**
Unit-5	
Green Buildings: Definition features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste ,Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings. Energy management	**Hours – 10**
COURSE OUTCOMES: Students will be able to: 1. Explain the principles, applications and uses of non conventional energy resources. 2. Apply the basic principles of conversion technologies of non conventional energy resources in to electric power. 3. Develop energy efficient systems 4. Demonstrate the concepts of energy efficient process 5. Outline features of an green buildings	
Question paper pattern: **Section A:** 1. This section contains ten one or two line answer questions carrying 1 mark each. 2. Two questions from each unit will be set. **Section B:** 1. This Section will have 05 questions with internal choice. 2. Each full question carries 12 marks. 3. Each full question comprises sub question covering all topics under a unit.	
Text Books: 1. Sukhatme S.P. and J.K.Nayak, Solar Energy – Principles of Thermal Collection and Storage, TMH. 2. Khan B.H., Non-Conventional Energy Resources, Tata McGrawHill, New Delhi, 2006 3. Green Manufacturing Processes and Systems, Edited by J. PauloDavim, Springer 2013 4. Alternative Building Materials and Technologies / K.S Jagadeesh,B.V Venkata Rama Reddy and K.S Nanjunda Ra.	
Reference Books: 1. Principles of Solar Energy / Frank Krieth & John F Kreider. 2. Non-Conventional Energy / Ashok V Desai /Wiley Eas 3. Renewable Energy Technologies /Ramesh & Kumar /Narosa tern 4. Renewable Energy Technologies/ G.D Roy	
Web Source References: http://nptel.iitm.ac.in https://en.wikipedia.org/wiki/Green_engineering https://www.informationvine.com/index?q=green+engineering&ad=semD&af=&	

amp;qsrc=999&askid=7ebb488a-

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1		3	2			2	2						3	
2		3	1			2	2						3	
3			1			1	1						3	
4				1	1	1	1						3	
5				2	2	2	2						3	
6				2	2	2	2						3	
Over all		1	1	1	1	2	2						3	

S.No.	Unit Name	Text Book Reference	Chapter No.
1.	Introduction: Solar Radiation, Solar Energy Collection, Solar Energy Storage and its Applications	T1	1,2,3,4,5,6
		T2	1,2,3,4,5,6
		R1	1,2,4
2.	Wind Energy, Bio Mass Energy, Geothermal Energy, Ocean Energy.	T1	7,8,9
		T2	7,8,9,10,11
		R1	2,3,4
		T2	12
		T3	1,2
		T3	3,4
3.	Green Buildings	T4	1,2,3

PRODUCTION PLANNING AND CONTROL (OPEN ELECTIVE)			
Subject Code	18MEXXO505X	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

COURSE OBJECTIVES: Students should be able to:

1. Understand the concepts of production and service systems
2. Acquire knowledge on the concepts of production planning and control
3. Apply forecasting techniques for various firms, namely qualitative & quantitative methods to optimize/make best use of resources in achieving their objectives.
4. Identify different strategies employed in manufacturing and service industries to plan inventory and Impart knowledge on the Materials Requirement Planning and Kanban, LOB and JIT Methods.
5. Determine the exact routing and scheduling which will be followed in production. And apply different scheduling policies in planning and control and make best use of resources.
6. Measure the effectiveness, identify likely areas for improvement, develop and implement improved planning and control methods for production systems.

Unit -1	**Teaching Hours**
Introduction: Definition – objectives and functions of production planning and control – elements of production control – types of production – organization of production planning and control department – internal organization of department. **Product Design:**Identification of product ideas and selection, product development and design	**Hours – 08**
Unit -2	
Forecasting – importance of forecasting – types of forecasting, their uses – general principles of forecasting – forecasting techniques – qualitative methods and quantitative methods.	**Hours – 10**
Unit – 3	
Inventory management – functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems Introduction to MRP I, MRP II, ERP, LOB (Line of Balance), JIT and KANBAN system.	**Hours – 10**
Unit – 4	
Routing & Scheduling– definition – routing procedure –route sheets – bill of material – factors affecting routing procedure, schedule –definition	**Hours – 12**

– difference with loading, Scheduling policies – techniques, standard scheduling methods, line balancing, aggregate planning.	
Unit-5	
Dispatching– activities of dispatcher – dispatching procedure – follow up – definition – reason for existence of functions – types of follow up, expediting, controlling aspects. Applications of computer in production planning and control.	**Hours – 10**

COURSE OUTCOMES:

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

1. Illustrate the systems concept for the design of production and service systems.
2. Explain the elements of Production Planning and control and discuss the role of internal organization
3. Develop forecasts in the manufacturing and service sectors using selected quantitative and qualitative techniques
4. Discuss the importance and function of inventory and to be able to apply selected techniques for its control and management under dependent and independent demand circumstances.
5. Select and use an appropriate principles/methods/ techniques/ modern concepts with reference to given application/situation in the preparation of route sheets with scheduling and loading in manufacturing systems.
6. Create andengage inlife-long learning in the context of technological change in Operations Management and also able to identify dispatching, follow-up activities in the system

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Elements of Production Planning and Control / Samuel Eilon/Universal Book Corp.
2. Manufacturing, Planning and Control/Partik Jonsson Stig-Arne

Reference Books:

1. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller/Prentice-Hall
2. Production Planning and Control/Mukhopadyay/PHI
3. Production Control A Quantitative Approach / John E. Biegel/Prentice-Hall

Web references:

1. http://nptel.ac.in/courses/112102106/
2. http://nptel.ac.in/courses/112107143/
3. http://nptel.ac.in/courses/112107142/33
4. http://nptel.ac.in/courses/112107142/31
5. https://nptel.ac.in/courses/112107142/36

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1		2	1						1		1		1	
2		2	1								3		1	
3		2									3		2	
4			1	1	1		3						1	
5				1	1		3				1	1	1	
6				1	1		3				2	2	1	
Over all		1	1	1	1		3		1		2	1	2	

S.No.	Unit Name	Text Book Reference	Chapter No.
1.	Introduction to PPC	T1	1,2,3,4,5
		T2	1,2
		R1	1,2
2.	Forecasting	T1	6
		T2	2,3&4
		R1	3,5
		R2	2
3.	Inventory management	T1	17
		T2	6,7
		R1	4,7&10
		R2	8
4.	Routing & Scheduling	T1	10,11,12,13,14
		T2	7,8
		R1	5,6
		R2	7,3
5.	Dispatching	T1	15,16
		T2	7,10
		R1	5,8

NANOTECHNOLOGY (OPEN ELECTIVE)			
Subject Code	18MEXXO505X	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES: Students should be able to

1. acquire knowledge on importance of Nanoscience & Nanotechnology
2. identify the properties of nanomaterials & their applications in material science.
3. familiarize the synthesis & fabrication of nanomaterials.
4. understand the various characterization techniques of nanomaterials.
5. discuss the concept of carbon nanotechnology & its applications.
6. evaluate the properties of nano materials in various applications

Unit -1	**Teaching Hours**
Introduction to Nanotechnology: Importance of nano-technology, Emergence of Nanotechnology, History of nanoscience, Definition of nanometer, nanomaterial & nanotechnology, classification of nanomaterials, basic applications of nanotechnology in field of science & technology.	**Hours – 10**
Unit -2	
Properties of Materials: Mechanical, thermal, and magnetic properties of nanomaterials, effect of size reduction on properties. Applications of nanotechnology in surface science, energy & environment.	**Hours – 8**
Unit – 3	
Synthesis and Fabrication: Synthesis of bulk polycrystalline samples, growth of single crystals, preparation of nanoparticle - bottom-up approach - sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD, top-down approach- Ball milling, micro fabrication, lithography, requirements for realizing semiconductor nanostructures.	**Hours – 10**
Unit – 4	
Charecterization Techniques: X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezoresponse microscopy, X-ray photoelectron spectroscopy, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy. Applications of nano structured thin films, applications of quantum dots.	**Hours – 12**
Unit-5	
Carbon Nanotechnology: Allotropes of Carbon, Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond,	**Hours – 10**

growth and morphology. Applications of nano crystalline diamond films, grapheme, and applications of carbon nano tubes, applications of carbon nanotechnology in biology and medicine.	

COURSE OUTCOMES: Students will be able to:

1. Explain the importance of Nanotechnology & its emergence in various fields
2. Identify various properties of nanomaterials in different applications.
3. Select manufacturing methods, techniques and process parameters for processing of nano materials.
4. Evaluate the properties of nanomaterials using different characterization tools & equipments.
5. Apply the concept of carbon allotropes in Nano Technology industrial applications.
6. Analyze the properties of nano materials in various applications

Question paper pattern:

Section A:

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B:

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Nanoscience and nanotechnology: M.S.Ramachandra Rao & Shubra singh/ Wiley publishers.

Reference Books:

1. Introduction to nanotechnology by Charles P.Poole.,J.Owens/ Wiley publishers
2. Nanotechnology by Jermy J Ramsden, Elsevier publishers
3. Nano Essentials- T Pradeep/TMH

Web Source References:

https://nptel.ac.in/courses/118102003/
https://nptel.ac.in/courses/103103033/module9/lecture1.pdf
https://nptel.ac.in/courses/103103026/13

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	3	3	2	1	3	2			2			1		
2	1	2	2	3	1				2		1	1		
3	3	1	1	1	3		2	2	2			3		
4	3	3	3	2	3		1	2	2			2		
5					2		2					1		
6							2					2		
Over all	3	3	3	2	3	2	2	2	2		1	2		

Unit	Topic	Text Book Reference	Page No.
1	Introduction to Nanotechnology	T1	1, 10
		T4	1,3
2	Properties of Materials	T1	2, 10
		T2	4,6
		T4	3,7
3	Synthesis and fabrication	T1	4
		T4	6,7
4	Characterization Techniques	T1	8, 10
		T2	3, 9
		T4	2,7,9
5	Carbon Nanotechnology:	T1	10
		T2	5,12
		T4	4,13,11

MECHATRONICS (OPEN ELECTIVE)			
Subject Code	18MEXXO505X	IA Marks	30
Number of Lecture Hours/Week	3(L)+1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits - 03

COURSE OBJECTIVES: Students should be able to

7. classify the different components and devices of mechatronics systems
8. understand the concept of Solid-state electronic devices
9. describe the structure of microprocessors and their applications in mechanical devices
10. gain the concept principle of automatic control and real time motion control systems, with the help of electrical drives and actuators
11. know the use of micro-sensors and their applications in various fields

Unit -1	**Teaching Hours**
Mechatronics systems – elements & levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers: classification-displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors	**Hours – 10**
Unit -2	
Solid state electronic devices - PN junction diode, BJT, FET, DIAC, TRIAC and LEDs. Analog signal conditioning, operational amplifiers, noise reduction, filtering.	**Hours – 8**
Unit - 3	
Hydraulic and pneumatic actuating systems - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electropneumatic, hydro-pneumatic, electro-hydraulic servo systems. Mechanical actuating systems and electrical actuating systems – basic principles and elements.	**Hours – 10**
Unit – 4	
Digital electronics and systems, digital logic control, microprocessors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control. Dynamic models and analogies, System response. Process Controllers – Digital Controllers, Programmable Logic Controllers, Design of mechatronics systems & future trends.	**Hours – 12**
Unit-5	
Micro mechatronic systems: Microsensors, Micro actuators; Micro-fabrication techniques LIGA Process: Lithography, etching, Micro-joining etc. Application examples; Case studies Examples of Mechatronic Systems from Robotics Manufacturing, Machine Diagnostics, Road	**Hours – 10**

vehicles and Medical Technology.	

COURSE OUTCOMES: Students will be able to:

7. Model, analyze and control engineering systems.
8. Identify sensors, transducers and actuators to monitor and control the behavior of a process or product.
9. Identify Hydraulic and pneumatic actuating systems.
10. Evaluate the performance of mechatronics systems.
11. Apply the use of micro-mechatronics systems in various fields & case studies.

Question paper pattern:

Section A:

3. This section contains ten one or two line answer questions carrying 1 mark each.
4. Two questions from each unit will be set.

Section B:

4. This Section will have 05 questions with internal choice.
5. Each full question carries 12 marks.
6. Each full question comprises sub question covering all topics under a unit.

Text Books:

1. Mechatronics System Design / Devdas shetty/Richard/Thomson.

Reference Books:

1. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition, Pearson, 2012 W. Bolton.
2. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
3. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
4. Mechatronics – Smaili A, Mrad F, Oxford Higher Education, Oxford University Press.
5. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
6. Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlsevier, Indian print

Web Source References:

https://nptel.ac.in/courses/112103174/2
https://lecturenotes.in/notes/2752-notes-for-mechatronics-mech-by-mohammed-nadeem-iqbalhttps://howtomechatronics.com

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1	3	3	3	1	2				2			1		
2	1	1		3	1				2		1	1		
3		1	1	3	1									
4	3	2	2	2	3		1	2	2			1		
5	1	1	1	3	1									
Over all	4	5	4	5	5	0	1	1	3	0	1	3	0	0

Course: Mechatronics

Text/Reference Books:

T1. Mechatronics System Design / Devdas shetty/Richard/Thomson.
T2. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition, Pearson, 2012 W. Bolton.
T3. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
T4. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
T5. Mechatronics – Smaili A, Mrad F, Oxford Higher Education, Oxford University Press.
T6. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
T7. Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlsevier, Indian print
T8. Mechatronics – HMT Ltd., Tata McGraw-Hill publishing Company Ltd.