ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABI
OF
MECHANICAL ENGINEERING
FOR
B.TECH REGULAR FOUR YEAR DEGREE COURSE
(for the batches admitted from 2016-2017)
&
for B.TECH LATERAL ENTRY COURSE
(for the batches admitted from 2017-2018)

SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
**(Affiliated to JNTUA Anantapuramu, Approved by AICTE
Accredited by NBA; NAAC with 'A' grade)**

SVEC16 - B.TECH - MECHANICAL ENGINEERING

VISION

To be one of the Nation's premier Engineering Colleges by achieving the highest order of excellence in Teaching and Research.

MISSION

➢ To foster intellectual curiosity, pursuit and dissemination of knowledge.

➢ To explore students' potential through academic freedom and integrity.

➢ To promote technical mastery and nurture skilled professionals to face competition in ever increasing complex world.

QUALITY POLICY

Sree Vidyanikethan Engineering College strives to establish a system of Quality Assurance to continuously address, monitor and evaluate the quality of education offered to students, thus promoting effective teaching processes for the benefit of students and making the College a Centre of Excellence for Engineering and Technological studies.

DEPARTMENT OF
MECHANICAL ENGINEERING

<u>VISION</u>

To become and be recognized as a nationwide center of excellence in Mechanical Engineering and allied areas for acquiring self-reliance through education, engagement and research.

<u>MISSION</u>

➢ Department of Mechanical Engineering is established to provide students with a sound Mechanical Engineering education, advance the understanding and application of Mechanical Engineering principles to work in multicultural and multidisciplinary environment.

➢ Engage and impart knowledge to the students for innovative, high-impact and leading edge research and development of modern Mechanical Engineering science through contemporary curriculum.

➢ Maintain a collegial, supportive, and diverse environment that encourages students, faculty, and staff to achieve to the best of their abilities.

➢ Serve our students by teaching them problem solving, leadership and teamwork skills, and the value of a commitment, quality and ethical behavior for their employability.

➢ Serve the community and industry through proactive knowledge exchange.

PROGRAM EDUCATIONAL OBJECTIVES

Within few years of graduation, B. Tech. (ME) Program, graduates would have:

1. Higher education in mechanical engineering, business administration, or other disciplines.

2. Career in mechanical engineering and allied industry, software industry, or managerial positions, and ability to start entrepreneurial ventures related to Mechanical Engineering.

3. Ability to recognize the importance of, and engage in life-long learning through self study for solving problems related to Mechanical Engineering.

PROGRAM OUTCOMES

On successful completion of the Program, the graduates of B. Tech. (ME) Program will be able to:

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. (Engineering knowledge)

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

3. 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. (Design/development of solutions)

4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the (Conduct investigations of complex problems) information to provide valid conclusions.

5. 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. (Modern tool usage)

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

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

8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. (Ethics)

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

10. 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. (Communication)

11. 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. (Project management and finance)

12. 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. (Life-long learning)

PROGRAM SPECIFIC OUTCOMES

On successful completion of B. Tech. (ME) Program, graduates will be able to:

1. Apply principles and concepts pertaining to Fundamental sciences, Humanities and Mechanical Engineering in solving problems of practical interest in sub domains of Manufacturing, Thermal, Design and Management Sciences.

2. Analyze problems of practical importance in research and industry by integrating engineering sciences.

3. Design mechanical components, systems or processes to meet desired functionality with realistic constraints.

4. Conduct investigations on complex engineering problems to obtain plausible solutions in the sub domains.

5. Apply appropriate analytical, experimental and computational tools and resources by integrating multifaceted requirements from various sub domains.

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The Challenge of Change

*"**M**astery of change is in fact the challenge of moving human attention from an old state to a new state. Leaders can shift attention at the right time and to the right place. The real crisis of our times is the crisis of attention. Those who lead are the ones who can hold your attention and move it in a purposeful way. Transformation is nothing but a shift in attention from one form to another. The form of a beautiful butterfly breaks free from a crawling caterpillar. If you pay enough attention, you would be able to see how the butterfly hides within the caterpillar. The leader points out a butterfly when the follower sees only a caterpillar".*

- Debashis Chatterjee

SREE VIDYANIKETHAN ENGINEERING COLLEGE
(Autonomous)
(Affiliated to J.N.T. University Anantapur, Anantapuramu)

ACADEMIC REGULATIONS

CHOICE BASED CREDIT SYSTEM

B.Tech. Regular Four Year Degree Program
(for the batches admitted from the academic year 2016–17)
&
B.Tech. (Lateral Entry Scheme)
(for the batches admitted from the academic year 2017–18)

For pursuing four year undergraduate Degree Program of study in Engineering (B.Tech) offered by Sree Vidyanikethan Engineering College under Autonomous status and herein after referred to as SVEC (Autonomous):

1. Applicability : All the rules specified herein, approved by the Academic Council, shall be in force and applicable to students admitted from the academic year 2016-2017 onwards. Any reference to "College" in these rules and regulations stands for SVEC (Autonomous).

2. Extent: All the rules and regulations, specified hereinafter shall be read as a whole for the purpose of interpretation and as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. It shall be ratified by Academic Council in the forth coming meeting. As per the requirements of statutory bodies, Principal, Sree Vidyanikethan Engineering College shall be the Chairman, Academic Council.

3.   Admission   :

3.1.   Admission into First Year of Four Year B.Tech. Degree Program of study in Engineering:

3.1.1.   Eligibility: A candidate seeking admission into the First Year of four year B.Tech. Degree Program should have
(i) passed either Intermediate Public Examination (I.P.E.) conducted by the Board of Intermediate Education, Andhra Pradesh, with Mathematics, Physics and Chemistry as optional courses (or any equivalent examination recognized by JNTUA, Anantapuramu) for admission as per the guidelines of Andhra Pradesh State Council of Higher Education (APSCHE).

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(ii) secured a rank in the EAMCET examination conducted by APSCHE for allotment of a seat by the Convener, EAMCET for admission.

3.1.2. **Admission Procedure:** Admissions shall be made into the first year of four year B.Tech. Degree Program as per the stipulations of APSCHE, Government of Andhra Pradesh:

(a) By the Convener, EAMCET, (for Category-A Seats).

(b) By the Management (for Category-B Seats).

3.2. Admission into the Second Year of Four year B.Tech Degree Program in Engineering (Lateral Entry).

3.2.1. **Eligibility:** A candidate seeking admission into the Second Year of four year B.Tech. Degree Program (Lateral Entry) should have

(i) Diploma in Engineering in the relevant branch conducted by the Board of Technical Education, Andhra Pradesh (or equivalent Diploma recognized by JNTUA, Anantapuramu).

(ii) Candidates qualified in ECET and admitted by the Convener, ECET. In all such cases for admission, when needed, permissions from the statutory bodies are to be obtained.

3.2.2. **Admission Procedure:** 20% of the sanctioned strength in each Program of study as lateral entry students or as stipulated by APSCHE shall be filled by the Convener, ECET.

4. Programs of study offered leading to the award of B.Tech. Degree Following are the four year undergraduate Degree Programs of study offered in various branches in SVEC (Autonomous) leading to the award of B.Tech (Bachelor of Technology) Degree:

1) B.Tech (Civil Engineering)

2) B.Tech (Computer Science & Engineering)

3) B.Tech (Computer Science & Systems Engineering)

4) B.Tech (Electrical & Electronics Engineering)

5) B.Tech (Electronics & Communication Engineering)

6) B.Tech (Electronics & Instrumentation Engineering)

7) B.Tech (Information Technology)

8) B.Tech (Mechanical Engineering)

5. Duration of the Program:

5.1 **Minimum Duration:** The program will extend over a period of four years leading to the Degree of Bachelor of Technology (B.Tech) of the JNTUA, Ananthapuramu. The four academic years will be divided into eight semesters with two semesters per year. Each semester shall normally consist of 22 weeks (?90 working days) having - Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System

(CBSS) as suggested by UGC and Curriculum/ Course Structure as suggested by AICTE are followed. Provision is made for lateral entry of students in the Second Year of the program in all branches of study and they will be required to satisfy the conditions of admissions thereto prescribed by the JNTUA, Ananthapuramu and Government of Andhra Pradesh.

5.2   Maximum Duration: The student shall complete all the passing requirements of the B.Tech degree program within a maximum duration of 8 years (6 years for lateral entry), these durations reckoned from the commencement of the semester to which the student was first admitted to the program.

First Semester (22 weeks)	Instruction Period: I Spell : 7 weeks II Spell: 9 weeks	16 weeks
	Mid-term Examinations: I Mid : 1 week II Mid : 1 week	2 weeks
	Preparation & Practical Examinations	2 weeks
	Semester-end examinations	2 weeks
	Semester Break	2 weeks
Second Semester (22 weeks)	Instruction Period: I Spell : 7 weeks II Spell: 9 weeks	16 weeks
	Mid-term Examinations: I Mid :1 week II Mid : 1 week	2 weeks
	Preparation & Practical Examinations	2 weeks
	Semester-end examinations	2 weeks
	Summer Vacation	6 weeks

6.   Structure of the Program: Each Program of study shall consist of:
(a) Foundation Courses,
(b) Core Courses and Elective Courses.
♦ Foundation Courses are further categorized as :
(i) HS (Humanities and Social Sciences),
(ii) BS (Basic Sciences) and
(iii) ES (Engineering Sciences).
♦ Core Courses and Elective Courses are categorized as PS (Professional Courses), which are further subdivided as:
(i) PC (Professional Core) Courses,
(ii) PE (Professional Electives),
(iii) IDE (Inter Disciplinary Electives),
(iv) OE (Open Electives),
(v) Comprehensive Assessment
(vi) Seminar
(vii) PW (Project Work).

S.No	Broad Course Classification	Course Group/ Category	Course Type	Range of Credits
1.	Foundation Courses	HS – Humanities and Social Sciences	Humanities, Social Sciences and Management.	5% - 10%
2.		BS – Basic Sciences	Mathematics, Physics and Chemistry Courses, etc.	15% - 20%
3.		ES – Engineering Sciences	Fundamental engineering courses.	15% - 20%
4.	Core Courses	PC – Professional Core	Core courses related to the Parent Discipline/ Branch of Engg.	30% - 40%
5.	Elective Courses	PE – Professional Electives	Elective courses related to the Parent Discipline/ Branch of Engg.	10% - 15%
6.		IDE - Interdisciplinary Electives	Courses in an area outside the Parent Discipline / Branch of Engg.	5% - 10%
7.		OE – Open Electives	Common Elective courses offered for all programs / Branches of Engg.	5% - 10%
8.	Core Courses	Seminar	A course of study with discussion and report.	10% - 15%
9.		Comprehensive Assessment	A comprehensive review of foundations and key concepts of the courses studied.	
10.		Project Work	A course of planned minor research work.	

Contact Periods: Depending on the complexity and volume of the course, the number of contact periods per week shall be assigned.

7.   Credit Courses:

All Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Course in a L: T: P: C (Lecture Periods: Tutorial Periods: Practical Periods: Credits) Structure, based on the following general pattern.

♦   One Credit - for One Period/ Week/ Semester for Theory/ Lecture (L) Courses;

♦   Two Credits - for Three Periods/ Week/ Semester for Laboratory/ Practical (P) Courses.

♦ Tutorials will not carry Credits.

  i) Other student activities like NCC, NSS, Sports, Study Tour, Guest Lecture etc. will not carry Credits.

  ii) For courses like Project/Seminar/Comprehensive Online Assessment, where formal contact periods are not specified, credits are assigned based on the complexity of the work to be carried out.

The four year curriculum of any B. Tech Program of study shall have total of **180** credits (24 credits in each semester from I B. Tech. I Semester to IV B. Tech I Semester and 12 credits in IV B. Tech II Semester). However the curriculum for lateral entry students shall have a total of **132** credits (24 credits in each semester from II B. Tech. I Semester to IV B. Tech I Semester and 12 credits in IV B. Tech II Semester).

8. Choice Based Credit System (CBCS):

Choice Based Credit System (CBCS) is introduced based on UGC guidelines in order to promote:

♦ Student centered learning

♦ Cafeteria approach

♦ Students to learn courses of their choice

♦ Learning at their own pace

♦ Interdisciplinary learning

♦ A student is introduced to "Choice Based Credit System (CBCS)"

♦ The total credits for the Program is **180** for regular students and **132** for lateral entry students.

♦ A student has a choice of registering for credits from the theory courses offered in the program ensuring the total credits in a semester are between 21 and 30.

♦ From the II B.Tech I Semester to IV B.Tech I Semester, the student has the option of registering for additional theory courses from the latter semesters or dropping existing theory courses of the current semester within the course structure of the program. However the number of credits the student can register in a particular semester should not below 21 (minimum) and should not exceed 30 (maximum).

♦ Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).

All the registered credits will be considered for the calculation of final CGPA.

9. Course Enrollment and Registration

9.1 Each student, on admission shall be assigned to a Faculty Advisor (Mentor) who shall advice and counsel the student about the details of the academic programme and the choice of courses considering the student's academic background and career objectives.

9.2 Each student on admission shall register for all the courses prescribed in the curriculum in the student's first and second Semesters of study. The student shall enroll for the courses with the help of the student's Faculty Advisor (Mentor). The enrollment for the courses from II B.Tech I Semester to IV B.Tech I Semester will commence 10 days prior to the last instructional day of the preceding semester for registration process. If the student wishes, the student may drop or add courses (vide clause 8) within Ten days before commencement of the concerned semester and complete the registration process duly authorized by the Chairman, Board of studies of concern department.

9.3 If any student fails to register the courses in a semester, he shall undergo the courses as per the program structure.

9.4 After registering for a course, a student shall attend the classes, satisfy the attendance requirements, earn Continuous Assessment marks and appear for the Semester-end Examinations.

9.5 No course shall be offered by a Department unless a minimum of 40 students register for that course.

10. Massive Open Online Course (MOOC)

A Massive Open Online Course (MOOC) is an online course aimed at unlimited participation and open access via the web. MOOC is a model for delivering learning content online to any person who takes a course, with no limit on attendance.

♦ A student shall undergo a "Massive Open Online Course (MOOC)" for award of the degree besides other requirements.

♦ A student is offered this Online Course at the beginning of his III B.Tech I Semester of study and the course has to be completed by the end of III B.Tech II Semester. If the student fails to complete the course by the end of III B.Tech II Semester, it shall be treated as a backlog and needs to be completed before completion of the program for the award of the degree.

♦ The student shall confirm registration by enrolling the course within 10 days prior to the last instructional day of the II B. Tech. II Semester like other courses.

♦ The courses will be approved by the Chairman, Academic Council, SVEC based on the recommendations of the Chairman, Board of Studies of concerned program considering current needs.

♦ A student has a choice of registering for only one MOOC with the recommendation of Chairman, Board of studies of concerned program and duly approved by the Chairman, Academic Council, SVEC.

- The student shall undergo MOOC without disturbing the normal schedule of regular class work.
- One faculty member assigned by the Head of the Department shall be responsible for the periodic monitoring of the course implementation.
- No formal lectures need be delivered by the faculty member assigned to the students.
- If any student wants to change the MOOC course already registered, he will be given choice to register a new MOOC course in III B. Tech. only, with the recommendation of Chairman, Board of studies of concerned program and duly approved by the Chairman, Academic Council, SVEC.
- Finally, the performance of the student in the course will be evaluated as stipulated by the course provider. A certificate will be issued on successful completion of the course by the course provider.
- The performance in the MOOC will not be considered for the calculation of SGPA and CGPA of the student.
- The MOOC course will be listed in the grade sheet of the student.

11.   Break of Study from a Program (Gap Year)

11.1   A student is permitted to go on break of study for a maximum period of two years either as two breaks of one year each or a single break of two years.

11.2   The student shall apply for break of study in advance, in any case, not later than the last date of the first assessment period in a semester. The application downloaded from website and duly filled by the student shall be submitted to the Head of the Department. In the case of start-up for incubation of idea only, the application for break of study shall be forwarded by the Head of the Department to the Principal, SVEC. A sub-committee appointed by the principal shall give recommendations for approval.

11.3   The students permitted to rejoin the programme after break of study shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new regulations shall apply to the Principal, SVEC in the prescribed format through Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.

11.4   The total period for completion of the programme reckoned from the commencement of the I B.Tech I Semester to which the student was admitted shall not exceed the maximum period specified in clause 5.2 irrespective of the period of break of study in order that the student may be eligible for the award of the degree (vide clause 18).

11.5   In case, if a student applies for break of study for one year and wishes to extend it for one more consecutive year, he shall be permitted with the prior approval of the Principal, SVEC through the concerned Head of the Department before beginning of the semester in which the student has taken break of study.

11.6 If a student has not reported to the department after approved period of break of study without any intimation, the student is treated as detained in that semester. Such students are eligible for readmission for the semester when offered next.

12. Examination System: All components in any Program of study shall be evaluated through internal evaluation and / or an external evaluation conducted as Semester-end examination.

Sl. No.	Course	Marks	Examination and Evaluation		Scheme of examination
1.	Theory	70	Semester-end examination of 3 hours duration (External evaluation)		The examination question paper in theory courses shall be for a maximum of 70 marks. The question paper shall be of descriptive type with 5 questions, taken one from each unit of syllabus, having internal choice and all 5 questions shall be answered. All questions carry equal marks.
		30	Mid-term Examination of 2 hours duration (Internal evaluation).		The question paper shall be of descriptive type with 4 essay type questions out of which 3 are to be answered and evaluated for 24 marks and also 6 short answer questions out of which all are to be answered and evaluated for 6 marks.
					Two mid-term examinations each for 30 marks are to be conducted. For a total of 30 marks, 75% of better one of the two and 25% of the other one are added and finalized. **Mid-I:** After first spell of instruction (I to II Units). **Mid-II**: After second spell of instruction (III to V Units).
2	Laboratory	50	Semester-end Lab Examination for 3 hours duration (External evaluation)		50 marks are allotted for laboratory/drawing examination during semester-end.
		50	30	Day-to-Day evaluation for Performance in laboratory experiments and Record. (Internal evaluation).	Two laboratory examinations, which includes Day-to-Day evaluation and Practical test, each for 50 marks are to be evaluated. For a total of 50 marks 75% of better one of the two and 25% of the other one are added and finalized. **Laboratory examination-I:** Shall be conducted just before I mid-term examinations. **Laboratory examination-II:** Shall be conducted just before II mid-term examinations.
			20	Practical test (Internal evaluation).	
3	a) Seminar	100	Semester-end Examination		100 marks are allotted for Seminar during semester-end evaluation by the Seminar Evaluation Committees (**SECs**) as given in 12.2.1.
	b)Comprehensive Assessment	100	Semester-end Examination		Comprehensive Assessment shall be conducted as given in 12.2.2 as semester-end evaluation for 100 marks.
4	Project Work	200	100	External evaluation	Semester-end Project Viva-Voce Examination by Committee as detailed in 12.2.3 for 100 marks.
			100	Internal evaluation	Continuous evaluation by the Project Evaluation Committees (**PECs)** as detailed in 12.2.3 for 100 marks.

12.2 Seminar/Comprehensive Assessment /Project Work Evaluation:

12.2.1 For the seminar, the student shall collect information through literature survey on a specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the Department just before presentation. The report and the presentation shall be evaluated at the end of the semester by the Seminar Evaluation Committees (SECs), each consisting of concerned supervisor and two senior faculty members. The SECs are constituted by the Principal on the recommendations of the Head of the Department.

12.2.2 Comprehensive Assessment shall be conducted by the department through (i) online with 50 objective questions for 50 marks and (ii) viva-voce for the remaining 50 marks, covering all the courses from I B.Tech I Semester to IV B.Tech I Semester. The viva-voce will be conducted by Comprehensive Assessment Committees (CACs), each consisting of three faculty members (out of whom at least two are seniors). The CACs are constituted by the Principal on the recommendations of the Head of the Department. The HODs of the respective departments are given the responsibility of preparing question bank/question paper for conducting the online examination.

12.2.3 The project Viva-Voce examination shall be conducted by a Committee consisting of External examiner (nominated by the Chief Controller of Examinations), HOD and concerned Supervisor. The evaluation of project work shall be conducted at the end of the IV B.Tech II Semester. The Internal Evaluation shall be made by the Project Evaluation Committees (PECs), each consisting of concerned supervisor and two senior faculty members on the basis of two project reviews conducted on the topic of the project. The PECs are constituted by the Principal on the recommendations of the Head of the Department.

12.3. Eligibility to appear for the semester-end examination:

12.3.1 A student shall be eligible to appear for semester-end examinations if he acquires a minimum of 75% of attendance in aggregate of all the courses in a semester.

12.3.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

12.3.3 Shortage of Attendance below 65% in aggregate shall in no case be condoned.

12.3.4 Students whose shortage of attendance is not condoned in any semester is not eligible to take their end examination of that class and their registration shall stand cancelled.

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12.3.5 A student shall not be promoted to the next semester unless he satisfies the attendance requirements of the current semester, as applicable. The student may seek readmission for the semester when offered next. He will not be allowed to register for the courses of the semester while he is in detention. A student detained due to shortage of attendance, will have to repeat that semester when offered next.

12.3.6 A stipulated fee shall be payable to the College towards condonation of shortage of attendance.

12.4. **Evaluation:** Following procedure governs the evaluation.

12.4.1. Marks for components evaluated internally by the faculty shall be submitted to the Controller of Examinations one week before the commencement of the End examinations. The marks for the internal evaluation components shall be added to the external evaluation marks secured in the Semester-end examinations, to arrive at total marks for any course in that semester.

12.4.2. Performance in all the courses is tabulated course-wise and shall be scrutinized by the Results Committee and moderation is applied if needed and course-wise marks are finalized. Total marks obtained in each course are converted into letter grades.

12.4.3. Student-wise tabulation shall be done and individual grade Sheet shall be generated and issued to the student.

12.5. **Personal verification / Revaluation / Recounting:**
Students shall be permitted for personal verification/request for recounting/ revaluation of the Semester-end examination answer scripts within a stipulated period after payment of prescribed fee. After recounting or revaluation, records are updated with changes if any and the student shall be issued a revised grade sheet. If there are no changes, the student shall be intimated the same through a notice.

12.6. **Supplementary Examination:**
In addition to the regular semester-end examinations conducted, the College may also schedule and conduct supplementary examinations for all the courses of other semesters when feasible for the benefit of students. Such of the candidates writing supplementary examinations may have to write more than one examination per day.

13. **Academic Requirements for promotion/ completion of regular B.Tech Program of study:**
The following academic requirements have to be satisfied in addition to the attendance requirements for promotion/ completion of regular B.Tech Program of study.

For students admitted into B.Tech. (Regular) Program:

13.1 A student shall be deemed to have satisfied the minimum academic requirements for each theory, laboratory course and project work, if he secures not less than 40% of marks in the semester-end examination and a minimum of 40% of marks in the sum total of the internal evaluation and Semester-end examination taken together. For the seminar and comprehensive Viva-Voce, he should secure not less than 40% of marks in the semester-end examination.

13.2 A student shall be promoted from second year to third year of Program of study only if he fulfills the academic requirement of securing 36 credits from
   a. Two regular and one supplementary examinations of I B.Tech I Semester.
   b. One regular and one supplementary examinations of I B.Tech II Semester.
   c. One regular examination of II B.Tech I Semester.
      Irrespective of whether or not the candidate appears for the semester-end examination as per the normal course of study.

13.3 A student shall be promoted from third year to fourth year of Program of study only if he fulfills the academic requirements of securing 60 credits from the following examinations,
   a. Three regular and two supplementary examinations of I B.Tech I Semester.
   b. Two regular and two supplementary examinations of I B.Tech II Semester.
   c. Two regular and one supplementary examinations of II B.Tech I Semester.
   d. One regular and one supplementary examinations of II B.Tech II Semester.
   e. One regular examination of III B.Tech I Semester.
   Irrespective of whether or not the candidate appears for the semester-end examination as per the normal course of study and in case of getting detained for want of credits by sections 13.2 and 13.3 above, the student may make up the credits through supplementary examinations.

13.4 A student shall register for all the 180 credits and earn all the 180 credits. Marks obtained in all the 180 credits shall be considered for the calculation of the DIVISION based on CGPA.

13.5 A student who fails to earn 180 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit his seat in B.Tech. Program and his admission stands cancelled.

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For Lateral Entry Students (batches admitted from the academic year 2017-2018):

13.6 A student shall be deemed to have satisfied the minimum academic requirements for each theory, practical course and project, if he secures not less than 40% of marks in the semester-end examination and a minimum of 40% of marks in the sum total of the internal evaluation and semester-end examination taken together. For the seminar and comprehensive Viva-Voce, he should secure not less than 40% of marks in the semester-end examination.

13.7 A student shall be promoted from third year to fourth year only if he fulfills the academic requirements of securing 36 credits from the following examinations.
a. Two regular and one supplementary examinations of II B.Tech I Semester.
b. One regular and one supplementary examinations of II B.Tech II Semester.
c. One regular examination of III B.Tech I Semester.
Irrespective of whether or not the candidate appears for the semester-end examination as per the normal course of study and in case of getting detained for want of credits the student may make up the credits through supplementary examinations.

13.8 A student shall register for all 132 credits and earn all the 132 credits. Marks obtained in all the 132 credits shall be considered for the calculation of the DIVISION based on CGPA.

13.9 A student who fails to earn 132 credits as indicated in the course structure within six academic years from the year of their admission shall forfeit his seat in B.Tech Program and his admission stands cancelled.

14. Transitory Regulations:
Students who got detained for want of attendance (or) who have not fulfilled academic requirements (or) who have failed after having undergone the Program in earlier regulations (or) who have discontinued and wish to continue the Program are eligible for admission into the unfinished semester from the date of commencement of class work with the same (or) equivalent courses as and when courses are offered and they will be in the academic regulations into which they are presently readmitted.

A regular student has to satisfy all the eligibility requirements within the maximum stipulated period of eight years and a lateral entry student within six years for the award of B.Tech Degree.

15. Grades, Semester Grade Point Average and Cumulative Grade Point Average:

15.1. Grade System: After all the components and sub-components of any course (including laboratory courses) are evaluated, the final total marks obtained shall be converted into letter grades on a "10 point scale" as described below.

Grades conversion and Grade points attached

% of Marks obtained	Grade	Description of Grade	Grade Points (GP)
> = 95	O	Outstanding	10
> = 85 to < 95	S	Superior	9
> = 75 to < 85	A	Excellent	8
> = 65 to < 75	B	Very Good	7
> = 55 to < 65	C	Good	6
> = 45 to < 55	D	Fair	5
> = 40 to < 45	E	Pass	4
< 40	F	Fail	0
Not Appeared	N	Absent	0

Pass Marks: A student shall be declared to have passed theory course, laboratory course and project work if he secures minimum of 40% marks in external examination, and a minimum of 40% marks in the sum total of internal evaluation and external examination taken together. For the seminar and comprehensive Assessment, he shall be declared to have passed if he secures minimum of 40% of marks in the semester-end examination. Otherwise he shall be awarded fail grade - **F** in such a course irrespective of internal marks. **F** is considered as a fail grade indicating that the student has to pass the semester-end examination in that course in future and obtain a grade other than **F** and **N** for passing the course.

15.2. **Semester Grade Point Average (SGPA):** SGPA shall be calculated as given below on a "10 point scale" as an index of the student's performance at the end of each semester:

$$SGPA = \frac{\sum (C \; X \; GP)}{\sum C}$$

where C denotes the credits assigned to the courses undertaken in that semester and GP denotes the grade points earned by the student in the respective courses.

Note: SGPA is calculated only for the candidates who passed all the courses in that Semester.

15.3. **Cumulative Grade Point Average (CGPA):**
The CGPA for any student is awarded only when he completes the Program i.e., when the student passes in all the courses prescribed in the Program. The CGPA is computed on a 10 point scale as given below:

$$CGPA = \frac{\sum (C \; X \; GP)}{\sum C}$$

where C denotes the credits assigned to courses undertaken up to the end of the Program and GP denotes the grade points earned by the student in the respective courses.

16. **Grade Sheet:** A grade sheet (Marks Memorandum) shall be issued to each student indicating his performance in all courses registered in that semester indicating the **SGPA.**

17. **Consolidated Grade Sheet:** After successful completion of the entire Program of study, a Consolidated Grade Sheet containing performance of all academic years shall be issued as a final record. Duplicate Consolidated Grade Sheet will also be issued, if required, after payment of requisite fee.

18. **Award of Degree**: The Degree shall be conferred and awarded by Jawaharlal Nehru Technological University Anantapur, Ananthapuramu on the recommendations of the Chairman, Academic Council of SVEC (Autonomous).

18.1. **Eligibility:** A student shall be eligible for the award of B.Tech Degree if he fulfills all the following conditions:
- Registered and successfully completed all the components prescribed in the Program of study to which he is admitted.
- Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of study within the stipulated time.
- Obtained CGPA greater than or equal to 4.0 (Minimum requirement for declaring as passed).
- Has no dues to the College, Hostel, Library etc. and to any other amenities provided by the College.
- No disciplinary action is pending against him.

18.2. **Award of Division:** Declaration of Division is based on CGPA.

Awarding of Division

CGPA	Division
> = 7.0	First Class with Distinction
> = 6.0 and < 7.0	First Class
> = 5.0 and < 6.0	Second Class
> = 4.0 and < 5.0	Pass Class

19. **Additional academic regulations:**

19.1 A student may appear for any number of supplementary examinations within the stipulated time to fulfill regulatory requirements for award of the degree.

19.2 In case of malpractice/improper conduct during the examinations, guidelines shall be followed as given in the Annexure-I.

19.3 Courses such as Project, Seminar and Comprehensive Assessment may be repeated only by registering in supplementary examinations.

19.4 When a student is absent for any examination (Mid-term or Semester-end) he shall be awarded zero marks in that component (course) and grading will be done accordingly.

19.5 When a component is cancelled as a penalty, he shall be awarded zero marks in that component.

20. Withholding of Results:
If the candidate has not paid dues to the College/University (or) if any case of indiscipline is pending against him, the result of the candidate shall be withheld and he will not be allowed/ promoted to the next higher semester.

21. Amendments to regulations:
The Academic Council of SVEC (Autonomous) reserves the right to revise, amend, or change the Regulations, Scheme of Examinations, and / or Syllabi or any other policy relevant to the needs of the society or industrial requirements etc., with the recommendations of the concerned Board(s) of Studies.

22. Attendance for student development activity periods indicated in the class time tables shall be considered as in the case of a regular course for calculation of overall percentage of attendance in a semester.

23. General:
The words such as "he", "him", "his" and "himself" shall be understood to include all students irrespective of gender connotation.

Note: Failure to read and understand the regulations is not an excuse.

Annexure-I

GUIDELINES FOR DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

Rule 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 course 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 course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.

(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 course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered 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 course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester. The Hall Ticket of the candidate is to be cancelled.
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 for four consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including labs and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester. The candidate is also debarred for four consecutive semesters from class work and all Semester-end examinations, if his involvement is established. Otherwise, The candidate is debarred for two consecutive semesters from class work and all Semester-end 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 examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all Semester-end 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 course only.
6.	Refuses to obey the orders of the Chief Controller of Examinations/Controller of Examinations/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 Controller of Examinations 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 Controller of Examinations, 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 unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester. If the candidate physically assaults the invigilator/Controller of the Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against them.

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 course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all Semester-end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with 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 course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred and forfeits the seat.

Note: Whenever the performance of a student is cancelled in any course(s) due to Malpractice, he has to register for Semester-end Examinations in that course(s) consequently and has to fulfill all the norms required for the award of Degree.

SREE VIDYANIKETHAN ENGINEERING COLLEGE

(Autonomous)
COURSE STRUCTURE
MECHANICAL ENGINEERING

I B.Tech. (I Semester)

Course code	Course Title	Contact Periods/ Week				Credits (C)	Scheme of Examination Max. Marks		
		L	T	P	Total		Internal Marks	External Marks	Total Marks
16BT1HS01	Technical English	3	1	0	4	3	30	70	100
16BT1BS01	Engineering Chemistry	3	1	0	4	3	30	70	100
16BT1BS03	Matrices and Numerical Methods	3	1	0	4	3	30	70	100
16BT1BS04	Multi-Variable Calculus and Differential Equations	3	1	0	4	3	30	70	100
16BT10501	Programming in C	3	1	0	4	3	30	70	100
16BT1HS31	English Language Lab	0	0	3	3	2	50	50	100
16BT1BS31	Engineering Chemistry Lab	0	0	3	3	2	50	50	100
16BT10331	Computer Aided Engineering Drawing	0	1	6	7	3	50	50	100
16BT10531	Programming in C Lab	0	0	3	3	2	50	50	100
	Total	15	6	15	36	24	350	550	900

I B.Tech. (II Semester)

Course code	Course Title	Contact Periods/ Week				Credits (C)	Scheme of Examination Max. Marks		
		L	T	P	Total		Internal Marks	External Marks	Total Marks
16BT1BS02	Engineering Physics	3	1	0	4	3	30	70	100
16BT2BS01	Transformation Techniques and Partial Differential Equations	3	1	0	4	3	30	70	100
16BT20102	Engineering Mechanics	4	1	0	5	4	30	70	100
16BT20241	Basic Electrical and Electronics Engineering	3	1	0	4	3	30	70	100
16BT20301	Engineering Materials	3	1	0	4	3	30	70	100
16BT1BS32	Engineering Physics Lab	0	0	3	3	2	50	50	100
16BT20251	Electrical and Electronics Engineering Lab	0	0	3	3	2	50	50	100
16BT20331	Engineering Workshop Practice	0	0	3	3	2	50	50	100
16BT20332	Materials Science Lab	0	0	3	3	2	50	50	100
	Total	16	5	12	33	24	350	550	900

II B.Tech. (I Semester)

S. No.	Course Code	Course Title	Contact Periods/ Week				Credits (C)	Scheme of Examination Max. Marks		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
		II Year – I Semester								
1	16BT3BS01	Probability Distributions and Statistical Methods	3	1	-	4	3	30	70	100
2	16BT30301	Engineering Metallurgy	3	1	-	4	3	30	70	100
3	16BT30302	Kinematics of Machinery	3	1	-	4	3	30	70	100
4	16BT30303	Manufacturing Technology	3	1	-	4	3	30	70	100
5	16BT30304	Strength of Materials	3	1	-	4	3	30	70	100
6	16BT30305	Thermodynamics	3	1	-	4	3	30	70	100
7	16BT30331	Computer Aided Machine Drawing Lab	-	-	3	3	2	50	50	100
8	16BT30332	Manufacturing Technology Lab	-	-	3	3	2	50	50	100
9	16BT30132	Strength of Materials Lab	-	-	3	3	2	50	50	100
		Total	**18**	**6**	**9**	**33**	**24**	**330**	**570**	**900**

II B.Tech. (II Semester)

S. No.	Course Code	Course Title	Contact Periods/ Week				Credits (C)	Scheme of Examination Max. Marks		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
		II Year – II Semester								
1	16BT3HS01	Environmental Studies	3	-	-	3	3	30	70	100
2	16BT40301	Design of Machine Elements – I	3	1	-	4	3	30	70	100
3	16BT40302	Dynamics of Machinery	3	1	-	4	3	30	70	100
4	16BT40303	Fluid Mechanics	3	1	-	4	3	30	70	100
5	16BT40304	Machine tools and Modern Machining Processes	3	1	-	4	3	30	70	100
6	16BT40305	Thermal Engineering - I	3	1	-	4	3	30	70	100
7	16BT40331	Fluid Mechanics Lab	-	-	3	3	2	50	50	100
8	16BT40332	Machine Tools Lab	-	-	3	3	2	50	50	100
9	16BT4HS31	Soft Skills Lab	-	-	3	3	2	50	50	100
		Total	**18**	**5**	**9**	**32**	**24**	**330**	**570**	**900**

III B.Tech. (I Semester)

S. No.	Course Code	Course Title	Contact Periods/ Week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
		III Year – I Semester								
1	16BT50301	Design of Machine Elements –II	3	1	-	4	3	30	70	100
2	16BT50302	Industrial Engineering and Management	3	1	-	4	3	30	70	100
3	16BT50303	Metrology and Measurements	3	1	-	4	3	30	70	100
4	16BT50304	Refrigeration and Air – conditioning	3	1	-	4	3	30	70	100
5	16BT50305	Thermal Engineering - II	3	1	-	4	3	30	70	100
6		Interdisciplinary Elective-1	3	1	-	4	3	30	70	100
	16BT50306	Human Resources Management								
	16BT50307	Instrumentation and Control Systems								
	16BT50308	Mechatronics								
	16BT40502	Database Management System								
7	16BT50331	Dynamics and Vibrations Lab	-	-	3	3	2	50	50	100
8	16BT50332	Internal Combustion Engines Lab	-	-	3	3	2	50	50	100
9	16BT50333	Metrology and Instrumentation Lab	-	-	3	3	2	50	50	100
		Total	**18**	**6**	**9**	**33**	**24**	**330**	**570**	**900**

III B.Tech. (II Semester)

S. No.	Course Code	Course Title	Contact Periods/ Week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
		III Year – II Semester								
1	16BT3HS02	Managerial Economics and Principles of Accountancy	3	1	-	4	3	30	70	100
2	16BT60301	CAD/CAM	3	1	-	4	3	30	70	100
3	16BT60302	Heat Transfer	3	1	-	4	3	30	70	100
4		Interdisciplinary Elective-2	3	1	-	4	3	30	70	100
	16BT60303	Non-Conventional Energy Sources								
	16BT50402	Microprocessors and Microcontrollers								
	16BT41202	Java programming								
	16BT51201	Computer Graphics and Multimedia								
5		Program Elective– 1	3	1	-	4	3	30	70	100
	16BT60304	Gas Turbines and Jet Propulsion								
	16BT60305	Hydraulics and Pneumatics								
	16BT60306	Mechanical Vibrations								
	16BT60307	Supply Chain Management								
6		Open Elective	3	1	-	4	3	30	70	100
7	16BT60331	CAD and Simulation Lab	-	-	3	3	2	50	50	100
8	16BT60332	Heat Transfer Lab	-	-	3	3	2	50	50	100
9	16BT60333	Seminar	-	-	-	-	2	-	100	100
10	16BT6MOOC	MOOC	-	-	-	-	-	-	-	-
		Total	**18**	**6**	**6**	**30**	**24**	**280**	**620**	**900**

SVEC16 - B.TECH - MECHANICAL ENGINEERING

S. No.	Course Code	Open Elective Course Title	S. No.	Course Code	Open Elective Course Title
1.	16BT6HS01	Banking and Insurance	16.	16BT60114	Disaster Mitigation and Management
2.	16BT6HS02	Business Communication and Career Skills	17.	16BT60115	Environmental Pollution and Control
3.	16BT6HS03	Cost Accounting and Financial Management	18.	16BT60116	Planning for Sustainable Development
4.	16BT6HS04	Entrepreneurship for Micro, Small and Medium Enterprises	19.	16BT60117	Professional Ethics
5.	16BT6HS05	French Language	20.	16BT60118	Rural Technology
6.	16BT6HS06	German Language	21.	16BT60308	Global Strategy and Technology
7.	16BT6HS07	Indian Constitution	22.	16BT60309	Intellectual Property Rights and Management
8.	16BT6HS08	Indian Economy	23.	16BT60310	Managing Innovation and Entrepreneurship
9.	16BT6HS09	Indian Heritage and Culture	24.	16BT60311	Materials Science
10.	16BT6HS10	Indian History	25.	16BT70412	Green Technologies
11.	16BT6HS11	Personality Development	26.	16BT70413	Introduction to Nanoscience and Technology
12.	16BT6HS12	Philosophy of Education	27.	16BT60505	Engineering System Analysis and Design
13.	16BT6HS13	Public Administration	28.	16BT71011	Micro-Electro-Mechanical Systems
14.	16BT60112	Building Maintenance and Repair	29.	16BT61205	Cyber Security and Laws
15.	16BT60113	Contract Laws and Regulations	30.	16BT61505	Bio-informatics

IV B.Tech. (I Semester)

S. No.	Course Code	Course Title	Contact Periods/ Week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
		IV Year – I Semester								
1	16BT70301	Automobile Engineering	3	1	-	4	3	30	70	100
2	16BT70302	Finite Element Method	3	1	-	4	3	30	70	100
3	16BT70303	Operations Research	3	1	-	4	3	30	70	100
4		Program Elective–2	3	1	-	4	3	30	70	100
	16BT70304	Cryogenics								
	16BT70305	Geometric Modeling								
	16BT70306	Quality Management and Reliability Engineering								
	16BT70307	Tool design								
5		Program Elective–3	3	1	-	4	3	30	70	100
	16BT70308	Computational Fluid Dynamics								
	16BT70309	Industrial Robotics								
	16BT70310	Product Design								
	16BT70311	Production and Operations Management								
6		Program Elective–4	3	1	-	4	3	30	70	100
	16BT70312	Power Plant Engineering								
	16BT70313	Project Management								
	16BT70314	Rapid Prototype Technology								
	16BT70315	Tribology								
7	16BT70331	Computer Aided Manufacturing and Automation Lab	-	-	3	3	2	50	50	100
8	16BT70332	Industrial Engineering Lab	-	-	3	3	2	50	50	100
9	16BT70333	Comprehensive Assessment	-	-	-	-	2	-	100	100
		Total	18	6	6	30	24	280	620	900

IV B.Tech. (II Semester)

S. No.	Course Code	Course Title	Contact Periods/ Week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
		IV Year – II Semester								
1	16BT80331	Project Work*	-	-	-	-	12	100	100	200
		Total	-	-	-	-	12	100	100	200

*Full-time project work

I B. Tech. - I Semester
(16BT1HS01) TECHNICAL ENGLISH
(Common to: CE, CSE, CSSE, IT & ME)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Intermediate English.

COURSE DESCRIPTION: Introduction to Communication; Active Listening; Effective Speaking; Reading; and Writing.

COURSE OUTCOMES:

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

CO1: Demonstrate knowledge in
- Process of communication.
- Modes of listening.
- Paralinguistic features.
- Skimming and Scanning.
- Elements of style in writin.

CO2: Analyze the possibilities and limitations of language for understanding
- Barriers to Communication.
- Barriers to Effective Listening.
- Barriers to Speaking.
- Formal and metaphorical language.

CO3: Design and develop functional skills for professional practice.

CO4: Apply writing skills in preparing and presenting documents.

CO5: Function effectively as an individual and as a member in diverse teams.

CO6: Communicate effectively with the engineering community and society in formal and informal situations**.**

DETAILED SYLLABUS:

UNIT-I : INTRODUCTION TO COMMUNICATION (09 Periods)

Introduction –Language as a Tool of Communication – Communicative Skills (Listening, Speaking, Reading and Writing) – Effective Communication – Modes of Communication – Barriers to Communication (classification).

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SVEC16 - B.TECH - MECHANICAL ENGINEERING

UNIT-II : **ACTIVE LISTENING**   **(09 Periods)**
Introduction – Reasons for poor Listening – Traits of a Good
Listener – Listening Modes – Types of Listening – Barriers to
Effective Listening – Listening for General Content and Specific
Information.
UNIT-III: EFFECTIVE SPEAKING   **(09 Periods)**
Introduction – Achieving Confidence, Clarity and Fluency –
Paralinguistic Features – Barriers to Speaking – Types of Speaking
– Persuasive Speaking.
UNIT-IV: READING   **(09 Periods)**
Introduction and Reading Rates – Reading and Interpretation –
Intensive and Extensive Reading – Critical Reading – Reading
for Different Purposes – SQ3R Reading Technique –Study Skills.
UNIT-V: WRITING   **(09 Periods)**
Introduction – Language – Elements of Style – Techniques for
Good Technical Writing – Referencing and Styling – Right Words
and Phrases – Sentences.
                                                  Total Periods: 45

TEXT BOOKS:
 1. Meenakshi Raman & Sangeetha Sharma, *Technical
     Communication*, Oxford University Press, New Delhi, 2012.

REFERENCE BOOKS:
1.   Ashraf Rizvi, *Effective Technical Communication*, McGraw-
     Hill Education (India) Pvt.Ltd., New Delhi, 2015.
2.   Sanjay Kumar & Pushp Lata, *Communication Skills*, Oxford
     University Press, New Delhi, 2013.
3.   Teri Kwal Gamble and Michael Gamble, *Communication
     Works,* Tata Mc Graw-Hill, New Delhi, 2010.
4.   Rajendra Pal and J.S. Korlahalli, *Essentials of Business
     Communication*, Sultan Chand and Sons (P) Ltd,
     New Delhi, 2010.

I B. Tech. - I Semester
(16BT1BS01) ENGINEERING CHEMISTRY
(Common to: CE, CSE, CSSE, IT & ME)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE REQUISITE: Intermediate/Senior Secondary Chemistry

COURSE DESCRIPTION: Water technology, Chemistry of Engineering materials, Nanochemistry, Green Chemistry, Electro chemical cells, Sensors, Corrosion and Lubricants.

COURSE OUTCOMES:

After completion of the course, a successful student is able to:

CO1: Acquire basic knowledge in water technology, engineering plastics, conducting polymers, composites, Electro chemical cells, Nano Chemistry, principles of Green Chemistry, corrosion phenomenon and lubricants.

CO2: Develop analytical skills in:
- Determination of hardness of water.
- Determination of viscosity, flame and fire points, cloud and pour points.

CO3: Develop designing skills in:
- Synthesis of engineering plastics.
- Chemical methods for the synthesis of Nano materials.

CO4: Develop skills for providing solutions through:
- Mitigation of hardness of water.
- Newer Nanomaterials and engineering plastics for specific applications

CO5: Acquire awareness to practice engineering in compliance to modern techniques such as:
- Nalgonda technique for defluoridation of water.
- Electroplating technique for control of corrosion.

CO6: Acquire awareness to societal issues on:
- Quality of water.
- Bio-diesel.
- Chemical materials utility and their impact.

DETAILED SYLLABUS:

UNIT—I: WATER TECHNOLOGY (09 Periods)

Introduction: Types of water, impurities in water and their consequences, types of hardness of water, units of hardness of water, disadvantages of hardness of water, estimation of hardness of water by EDTA method, Boiler troubles: Scales and Sludges, Caustic embrittlement, Boiler corrosion and Priming and Foaming.

Softening of water: Zeolite process and Ion exchange process, advantages and disadvantages. Desalination of brackish water by Reverse Osmosis, Numerical problems on estimation of hardness of water.

Fluorides in water: Effects on human health, defluoridation method-Nalgonda method; comparison of merits and demerits of various defluoridation methods (Nalgonda, Bone Charcoal, Activated Alumina, Contact precipitation, Brick, Reverse osmosis).

UNIT—II: CHEMISTRY OF ENGINEERING MATERIALS (09 Periods)

Engineering Plastics: Definition, general properties, synthesis, properties and applications of PC, PTFE, and PMMA.

Conducting polymers: Definition, types of conducting polymers: Intrinsic and extrinsic conducting polymers with examples, engineering applications of conducting polymers.

Biodegradable polymers: Definition, properties, classification, mechanism of degradation of biodegradable polymers and their applications.

Composites – Introduction, types of composites: fiber reinforced particulate and layered composites with examples, advantages of composites and applications.

UNIT—III: NANOCHEMISTRY AND GREEN CHEMISTRY (09 Periods)

Nanochemistry: Introduction, classification, properties and applications of Nano materials (nano particles, nano tubes, nano wires, nano composites, dendrimers); synthesis of Nano materials – Sol-gel process.

Green Chemistry: Introduction, principles of green chemistry, Tools of Green Chemistry with Examples, Applications of Green Chemistry in science and technology.

Biodiesel: Introduction, Synthesis (Transesterification method), advantages, disadvantages and applications.

UNIT—IV: ELECTROCHEMICAL CELLS AND SENSORS
(09 Periods)

Electrochemical cell: Introduction, EMF of an electrochemical cell.

Batteries: Introduction, types of Batteries: primary and secondary batteries with examples, Ni-Cd batteries, Lithium-ion batteries, Lithium- Polymer batteries, Applications of batteries.

Fuel Cells: Definition, examples: $H_2 - O_2$ Fuel cell, solid oxide fuel cell, Bio-fuel cell and applications of fuel cells.

Sensors - Introduction, Types of Sensors, electrochemical sensor: construction and working principle of potentiometric sensor, and applications of electrochemical sensors.

UNIT—V: CORROSION AND LUBRICANTS (09 Periods)

Corrosion: Introduction, Definition, types of corrosion (dry and wet corrosion), galvanic corrosion, concentration cell corrosion, Factors influencing corrosion, Corrosion control: cathodic protection; sacrificial anodic protection and impressed current cathodic protection; protective coatings: Galvanizing and Electroplating (Nickel).

Lubricants: Definition, functions of lubricants, mechanism of lubrication, classification of lubricants, properties of lubricants – viscosity, flash and fire points, cloud and pour points, Aniline points, neutralization number and mechanical strength.

Total Periods: 45

TEXT BOOKS:

1. P.C.Jain & Monika Jain, *Engineering Chemistry,* Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 16th edition, 2013.

2. K.N. Jayaveera, G.V. Subba Reddy & C. Ramachandraiah *Engineering Chemistry,* Mc. Graw-Hill Higher Education, Hyderabad, 1st edition, 2015.

REFERENCE BOOKS:

1. A.K. Bandyopadhyay, *Nano Materials*, New Age international publishers, 2nd edition, 2014.

2. Paul T. Anastas and John C Warner, *Green Chemistry: Theory and practice,* Oxford University Press, 2000.

I B. Tech. - I Semester
(16BT1BS03) MATRICES AND NUMERICAL METHODS
(Common to all Branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Intermediate /Senior secondary mathematics

COURSE DESCRIPTION: Fundamentals of matrix theory; numerical solutions of equations, curve fitting; interpolation; numerical differentiation and integration; numerical solutions of ordinary differential equations.

COURSE OUTCOMES: After completion of the course a successful student is able to

CO1: Acquire basic knowledge in
- Finding the rank of matrices and analyzing them.
- Solving algebraic and transcendental equations by various numerical methods.
- Fitting of various types of curves to the experimental data.
- Estimating the missing data through interpolation methods.
- Identification of errors in the experimental data
- Finding the values of derivatives and integrals through various numerical methods.
- Solving differential equations numerically when analytical methods fail.

CO2: Develop skills in analyzing the
- methods of interpolating a given data
- properties of interpolating polynomials and derive conclusions
- properties of curves of best fit to the given data
- algebraic and transcendental equations through their solutions
- properties of functions through numerical differentiation and integration
- properties of numerical solutions of differential equations

CO3: Develop skills in designing mathematical models for
- Fitting geometrical curves to the given data

- Solving differential equations
- Constructing polynomials to the given data and drawing inferences.

CO4: Develop numerical skills in solving the problems involving
- Systems of linear equations
- Fitting of polynomials and different types of equations to the experimental data
- Derivatives and integrals
- Ordinary differential equations

CO5: Use relevant numerical techniques for
- Diagonalising the matrices of quadratic forms
- Interpolation of data and fitting interpolation polynomials
- Fitting of different types of curves to experimental data
- obtaining derivatives of required order for given experimental data
- Expressing the functions as sum of partial fractions

DETAILED SYLLABUS:

UNIT–I : MATRICES   (11 Periods)

Rank of a matrix, echelon form, normal form, inverse of a matrix by elementary row operations. Solutions of linear system of equations. Eigen values, Eigen vectors and properties (without proof), Diagonalization. Quadratic form (QF), reductions to canonical form using orthogonal transformation and nature of QF.

UNIT-II: NUMERICAL SOLUTIONS OF EQUATIONS AND CURVE FITTING   (08 Periods)

Solutions of Algebraic and Transcendental equations by bisection method, Regula-Falsi method, Newton – Raphson's method. Curve fitting by the principle of least squares, fitting of a straight line, parabola and exponential curves.

UNIT-III: INTERPOLATION   (08 Periods)

Interpolation, difference operators and their relationships, Newton's forward and backward formulae, Lagrange's interpolation formula. Partial fractions using Lagrange's interpolation formula.

UNIT-IV: NUMERICAL DIFFERENTIATION AND INTEGRATION   (08 Periods)

Numerical differentiation using Newton's forward and backward formulae. Numerical integration using Trapezoidal rule, Simpson's $1/3^{rd}$ rule and $3/8^{th}$ rule.

UNIT-V: NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS   (10 Periods)

Numerical solutions of first order Initial value problems using Taylor series method, Euler's method , modified Euler's method, Runge – Kutta method (4 thorder only) and Milne's predictor – corrector method.

                                                    Total Periods: 45

TEXT BOOK:

1. T.K.V. Iyenger, B. Krishna Gandhi, S.Ranganadham and M.V.S.S.N.Prasad, *Mathematical Methods,* S.Chand and Company, 8/e, 2013

REFERENCE BOOKS:

1. B.S. Grewal, *Higher engineering mathematics*, Khanna Publishers, 42nd Edition. 2012
2. S.S.Sastry, *Introductory methods of Numerical Analysis*, Prentice Hall of India, 5/e, 2013

I B. Tech. - I Semester
(16BT1BS04) MULTI-VARIABLE CALCULUS AND DIFFERENTIAL EQUATIONS
(Common to all Branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Intermediate /Senior secondary mathematics

COURSE DESCRIPTION: First order differential equations; higher order linear differential equations; functions of several variables; applications of integration; multiple integrals; vector calculus.

COURSE OUTCOMES: After completion of the course a successful student is able to

CO1: Acquire knowledge in
- Higher order Differential equations
- Maximum and minimum values for the functions of several variables
- Double and triple integrals
- Differentiation and integration of vectorfunctions.
- Line and surface volume
- transforming integrals from three dimensional surfaces and volumes on to plane surfaces

CO2: Develop skills in analyzing the
- Methods for differential equation for obtaining appropriate solutions,
- Properties of oscillatory electrical circuits and heat transfer in engineering systems
- The variations in the properties of functions near their stationary values
- Flow patterns of fluids, electrical and magnetic flux and related aspects

CO3: Develop skills in designing mathematical models for
- R-C and L-R-C oscillatory electrical circuits
- Heat transfer and Newton's law of cooling
- Engineering concepts involving lengths of curves and areas of planes, Flux across surfaces

CO4: Develop analytical skills in solving the problems involving
- Newton's law of cooling
- non homogeneous linear differential equations

- maximum and minimum values for the functions
- lengths of curves, areas of surfaces and volumes of solids in engineering
- transformation of integrals from three dimensional surfaces and volumes on to plane surfaces

CO5: Use relevant mathematical techniques for evaluating
- various types of particular integrals in differential equations
- stationary values for multi variable functions
- multiple integrals in change of variables
- integrations of vector functions.

DETAILED SYLLABUS:

UNIT-I: FIRST ORDER DIFFERENTIAL EQUATIONS
                                    (06 Periods)
Linear and Bernoulli type, exact equations and reducible to exact. Orthogonal trajectories (Both Cartesian and polar forms). Newton's law of cooling.

UNIT-II: HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS
                                    (09 Periods)
Method for solution of linear equations- Differential operator D, Solution of second order linear homogeneous equations with constant coefficients, Solution of Higher order homogeneous linear equations with constant coefficients.

Solution of Non homogeneous linear equations-Operator methods for finding particular integrals- for cases – e^{ax}, $\sin ax$, $\cos ax$, x^n, $e^{ax}V(x)$, $xV(x)$. Method of Variation of parameters. Applications to oscillatory electrical circuits.

UNIT-III: FUNCTIONS OF SEVERAL VARIABLES   (08 Periods)
Functions of Two Variables: Limits, Continuity; **Partial Derivatives**: Total Differential and Derivatives, Jacobian, Functional dependence, Taylor's Theorem, maxima and minima of functions of two variables with and without constraints – Lagrange's method of undetermined multipliers.

UNIT-IV: APPLICATIONS OF INTEGRATION AND MULTIPLE INTEGRALS   (10 Periods)
Applications of integration to – lengths of curves, areas of surfaces of revolution, Double and Triple integrals – change of order of integration, change of variables in integrals. Area enclosed by plane curves, volumes of solids.

UNIT-V: VECTOR CALCULUS   **(12 Periods)**

Vector differentiation: Gradient of a scalar field and Directional Derivative, Divergence and Curl of a Vector field

Line integrals: Line integrals independent of path – work done.

Surface area and Surface Integrals: Surface Area, Surface Integrals, Flux across a surface.

Green's Theorem: Green's Theorem (without proof)verification-applications

Gauss Divergence Theorem and Stoke's Theorem: Gauss Divergence theorem (without proof), Stokes's Theorem (without proof) –verifications and applications.

                                        Total Periods: 45

TEXT BOOK:
1.   T.K.V. Iyengar, B. Krishna Gandhi,S.Ranganatham and M.V.S.S.N. Prasad, *Engineering Mathematics,* Vol-1, S. Chand &Company, 13/e, 2014

REFERENCE BOOKS:
1. Grewal, B.S., *Higher engineering mathematics,*Khanna publishers, Delhi, 42/e. 2012.

2. Kreyszig, E., *Advanced Engineering Mathematics,*John Wiley and Sons, Inc.,9/e.2012.

I B. Tech. - I Semester
(16BT10501) **PROGRAMMING IN C**
(Common to all Branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: NIL

COURSE DESCRIPTION:

Program design; Operators and Expressions; Data Input and Output; Control Statements; Functions; Arrays; Strings; Pointers; Structures & Unions and File handling Techniques;

COURSE OUTCOMES:

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

CO1: Demonstrate knowledge in:
- Elements of C Language
- Selection and Repetition statements.
- Arrays, Strings and Functional statements.
- Derived data types, Files and Pointers

CO2: Analyze complex engineering problems to develop suitable solutions

CO3: Design algorithms for specified engineering problems

CO4: Use appropriate 'C' language constructs for solving engineering problems

CO5: Write programs using 'C' language to implement algorithms

DETAILED SYLLABUS:

UNIT -I : INTRODUCTION TO C PROGRAMMING, OPERATORS & EXPRESSIONS (08 Periods)

Introduction to C Programming: The C Character set, Writing First Program of C, Identifiers and Keywords, Data types, Constants, Variables and Arrays, Declarations, Expressions, Statements and Symbolic Constants.

Operators and Expressions: Arithmetic Operators, Unary Operators, Relational and Logical Operators, Assignment Operators, the Conditional Operators.

UNIT -II : DATA INPUT AND OUTPUT & CONTROL STATEMENTS (08 Periods)

Data Input and Output: Single Character Input and Output, Input Data & Output data, The gets and puts Function.

Control Statements: Branching: The if-else Statement, Looping: The while Statement, More Looping: The do-while Statement, Still More Looping: The for Statement, Nested Control Statement, The switch Statement, The break & continue Statements, The goto Statement.

UNIT-III: FUNCTIONS, PROGRAM STRUCTURES & ARRAYS
(11 Periods)

Functions: A Brief Overview, Defining a Function, Accessing a Function, Function Prototypes, Parsing Argument to a Function, Recursion.

Program Structure: Storage Classes, Automatic Variables, External (Global) Variables, Static Variables, Multi file Programs,

Arrays: Defining an Array, Processing an Array, Processing Array to function, Multidimensional Arrays. Linear search, Binary search, Fibonacci search, Bubble sort and Insertion sort

UNIT-IV: STRINGS & POINTERS   (09 Periods)

Strings: Defining a String, NULL Character, Initialization of Strings, Reading and Writing a String, Processing a Strings, Character Arithmetic, Searching and Sorting of Strings, Library Functions for Strings.

Pointers: Pointer Declaration, Passing Pointers to a Function, Pointers and One-dimensional Arrays, Dynamic Memory Allocation, Operations on Pointers, Pointers and Multidimensional Arrays, Arrays of Pointers.

UNIT-V: STRUCTURES AND UNIONS & FILE HANDLING
(09 Periods)

Structures and Unions: Defining a Structure, Processing a Structure, User-Defined Data types (typedef), Structures and Pointers, Passing Structures to Function, Self –Referential Structures, Unions

File Handling: Files introduction, Opening and Closing a Data File, Reading and Writing a Data File, Processing a Data File, Unformatted Data File, Concept of Binary Files, Accessing the File Randomly.

Total Periods: 45

TEXT BOOK:
1.   Byron Gottfried and Jitender Kumar *C, Programming with C*, Third Edition, McGraw Hill Education (India) Pvt, Ltd, New Delhi, 2016.

REFERENCE BOOKS:
1.   PradipDey and Manas Ghosh, *Programming in C,* Second Edition, Oxford University Press, NewDelhi, 2007.
2.   E. Balagurusamy, *Programming in C,* Seventh Edition, Mc Graw Hill Education (India) Pvt, Ltd, New Delhi, 2014.

I B. Tech. - I Semester
(16BT1HS31) **ENGLISH LANGUAGE LAB**
(Common to CSE, CSSE, IT, CE & ME)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: English at intermediate or equivalent level.

COURSE DESCRIPTION: Phonetics; Vocabulary Building; Functional Grammar; Just a Minute; Elocution/Impromptu; Giving Directions/Conversation Starters; Role Play; Public Speaking; Describing People, Places, Objects and Events; Reading Comprehension; Listening Comprehension; Information Transfer.

COURSE OUTCOMES:

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

CO1: Demonstrate knowledge in
- Phonetics
- Information Transfer

CO2: Analyze the situations in professional context by using
- Vocabulary
- Grammar

CO3: Design and develop functional skills for professional practice.

CO4: Apply the techniques of Listening and Reading skills to comprehend Listening and Reading comprehension.

CO5: Function effectively as an individual and as a member in diverse teams through
- Extempore talk and
- Role Play

CO6: Communicate effectively in public speaking in formal and informal situations.

CO7: Recognize the need to engage in lifelong learning to upgrade competence of knowledge and communication.

LIST OF EXERCISES

1. Phonetics
2. Vocabulary Building
3. Functional Grammar
4. Just a Minute
5. Elocution/Impromptu
6. Giving Directions/Conversation Starters
7. Role Play
8. Public Speaking
9. Describing People, Places, Objects and Events.

10. Reading Comprehension
11. Listening Comprehension
12. Information Transfer

TEXT BOOK:
1. Department Lab Manual

REFERENCE BOOKS:
1. D. Sudha Rani, *A Manual for English Language Laboratories*, Pearson Education.
2. D. Sudha Rani, *Advanced Communication Skills Laboratory Manual*, Pearson Education.
3. R. Manivannan and G. Immanuel, *Communication Skills Laboratory*, VK Publications, Sivakasi, 2013
4. Nira Kumar*, English Language Laboratories*, PHI Learning Pvt. Ltd., New Delhi, 2011.

SUGGESTED SOFTWARE:
1. ETNL Language Lab Software Version 4.0
2. GEMS - Globarena E- Mentoring System.
3. Speech Solutions.
4. English Pronunciation Dictionary by Daniel Jones.
5. Learn to Speak English 8.1, The Learning Company - 4 CDs.
6. Mastering English: Grammar, Punctuation and Composition.
7. English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
8. Dorling Kindersley Series - Grammar.
9. Language in Use 1, 2 & 3.
10. Cambridge Advanced Learner's Dictionary - 3rd Edition.
11. Centronix - Phonetics.
12. Let's Talk English, Regional Institute of English South India.
13. The Ultimate English Tutor.

I B. Tech. - I Semester
(16BT1BS31) ENGINEERING CHEMISTRY LAB
(Common to: CE, CSE, CSSE, IT & ME)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE REQUISITE: Intermediate/Senior Secondary Chemistry

COURSE DESCRIPTION: Estimation of hardness, alkalinity, dissolved oxygen of water samples and estimation of Iron by volumetric methods, determination of effect of P^H on rate of corrosion, measurement of viscosity of lubricants; Instrumental methods like potentiometer, conductivity meter, P^H meter and colorimeter; synthesis of Polymers and Nano materials.

COURSE OUTCOMES:

After completion of the course, a successful student is able to:

CO1: Acquire basic Knowledge about the volumetric analysis and synthesis of materials used for engineering applications.

CO2: Acquire analytical skills in the estimation of hardness of water, alkalinity of water, dissolved oxygen in water and estimation of Iron through wet laboratory methods.

CO3: Develop designing skills for the synthesis of polymers and Nanomaterials.

CO4: Acquire skills to use instrumental techniques for the determination of Electrical conductance of electrolytes, EMF of a cell, PH of a solution, determination of viscosity of lubricants and estimation of iron in cement.

CO5: Provide solutions for environmental issues through determination of quality of water.

List of Experiments

A minimum of any **Ten** experiments are to be conducted among the following: .

1. Estimation of Hardness of water by EDTA method.
2. Estimation of alkalinity of Water.
3. Estimation of Dissolved Oxygen in water.
4. Estimation of Ferrous Iron by Dichrometry.
5. Preparation of Novalac Resin.
6. Synthesis of Nano metal-oxide using sol– gel process.
7. Conductometric titration of strong acid Vs strong base
8. Estimation of Ferrous ion by Potentiometry.
9. Determination of amount of corrosion of metals in different medium
10. Measurement of viscosity of lubricants by Ostwald viscometer.
11. Determination of pH of a given solution by pH metry.
12. Estimation of Ferric iron in cement by Colorimetric method.

I B. Tech. - I Semester
(16BT10331) COMPUTER AIDED ENGINEERING DRAWING
(Common to: CE, CSE, CSSE, IT & ME)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	1	6	3

PRE-REQUISITES: --

COURSE DESCRIPTION:

Engineering drawing conventions; importance of engineering drawing; fundamental concepts of sketching; computed aided drafting and different types of projections of geometric entities (both 2D and 3D) through computer aided drafting packages.

COURSE OUTCOMES:

After completion of the course, a successful student is able to:

CO1: Understand, write and read the language of engineering drawing in industry through International System of Standards.

CO2: Develop the imagination and mental visualization ability for interpreting the geometrical details of engineering objects.

CO3: Produce different views and projection in drawing.

CO4: Use modern CAD software for design and drafting of drawings.

CO5: Create multi-view drawings suitable for presentation to Engineering community.

CO6: Introduce and communicate universally accepted conventions and symbols for their usage in technical drawing.

DETAILED SYLLABUS:

UNIT-I: BASICS OF ENGINEERING DRAWING PRACTICE, GEOMETRICAL CONSTRUCTIONS, CONICS AND SPECIAL CURVES   (18 Periods)

Introduction, drawing instruments and its uses, sheet layout, BIS conventions, lines, lettering and dimensioning practices. Geometrical constructions: Construction of regular polygons: Pentagon, Hexagon, Heptagon and Octagon. Conic sections**:** Introduction, construction of ellipse: rectangular method, eccentricity method. Construction of parabola: rectangular method, eccentricity method. Construction of hyperbola: eccentricity method. Special curves*:* cycloid, involute.

UNIT-II: INTRODUCTION TO COMPUTER AIDED SKETCHING
(18 Periods)

Computer screen, layout of the software, creation of 2D/3D environment, selection of drawing size and scale, Standard tool bar/menus, Coordinate system, description of most commonly used toolbars, navigational tools: commands and creation of lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity.

UNIT-III: PROJECTION OF POINTS, STRAIGHT LINES AND PLANES **(21 Periods)**

Introduction, method of projection, planes of projection, reference line and notations. Projection of points: Points in all the four quadrants. Projection of straight lines: lines inclined to HP / VP plane, inclined to both HP and VP planes (straight lines are assumed to be in first quadrant only). Projection of planes: projection of triangle, square, rectangle, rhombus, pentagon, hexagon and circular plane for the condition inclined to HP / VP by change of position method.

UNIT-IV: PROJECTION OF SOLIDS AND SECTION OF SOLIDS
(21 Periods)

Projections of Solids: Introduction, projection of solids: prisms, pyramids, cylinders and cones with axis perpendicular to VP/HP and axis inclined to VP/HP only. Sections of solids: Introduction, Cutting plane, sectional views of right regular solids resting with base on HP: prisms, pyramids, cylinder and cone and true shapes of the sections.

UNIT-V: ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS AND DEVELOPMENT OF SURFACES **(22 Periods)**

Orthographic projection: simple exercises. Isometric projection: Simple exercises.
Development of surfaces: prisms, pyramids, cylinders, cone and miscellaneous surfaces

Total Periods: 100

Note: Student shall practice Unit-I using sketch book only and remaining units using sketch book first and later CAD package.

TEXT BOOKS:

1. D.M.Kulkarni, A.P.Rastogi, A.K.Sarkar, *Engineering Graphics with AutoCAD*, PHI Learning Private Limited, New Delhi, Revised Edition, 2010.

2. N D Bhat & V M Panchal, *Engineering Drawing*, Charotar Publishing House, Gujarat, 51st edition, 2013.

REFERENCE BOOKS:

1. Sham Tickoo, AutoCAD 2013 for Engineers and Designers, Dreamtech Press, 2013.

2. M.H.Annaiah & Rajashekar Patil, *Computer Aided Engineering Drawing*, New Age International Publishers, 4th Edition, 2012.

3. T.Jeyapoovan, E*ngineering Drawing and Graphics Using AutoCAD*, Vikas Publishing House, 3rd Edition, 2010.

4. Jolhe, *Engineering Drawing*, Tata McGraw Hill Education Private Limited, 1st Edition, 2007.

5. Basant Aggarwal, *Engineering Drawing,* Tata McGraw Hill Education Private Limited, 1st Edition, 2008.

I B. Tech. - I Semester
(16BT10531) PROGRAMMING IN C LAB
(Common to all Branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: A course on "Programming in C"

COURSE DESCRIPTION: Hands on practice in developing and executing simple programs using C Programming constructs– Conditional statements, Loops, Arrays, Strings, Functions, Structures, Pointers and Functions.

COURSE OUTCOMES:

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

CO1: Demonstrate practical knowledge of using C language constructs:
- Selection and Repetition statements.
- Arrays, Strings and Functional statements.
- Derived data types, Files and Pointers

CO2: Analyze problems to develop suitable algorithmic solutions.

CO3: Design Solutions for specified engineering problems.

CO4: Use appropriate 'C' language constructs for solving engineering problems.

CO5: Implement and execute programs using 'C' language

CO6: Document programs and communicate effectively while conducting Professional transactions.

List of Exercises:

1. a. Let a and b are two integer variables whose values are 10 and 13 respectively. Write a program to evaluate the following arithmetic expressions.

   i) a + b   ii) a–b   iii) a * b   iv) a/b   v) a % b

   b. Write a program to evaluate the following algebraic expressions after reading necessary values from keyword.

   i) $(ax + b)/(ax - b)$

   ii) $2.5 \log x + \cos 32^0 + | x^2 + y^2|$

   iii) $x^5 + 10 x^4 + 8$ and $x^3 + 4 x + 2$

   iv) ae^{kt}

2. a. Mr. Gupta deposited Rs.1000 in a bank. The bank gives simple interest at the rate of 15% per annum. Write a

program to determine the amount in Mr. Gupta's account at the end of 5 years. (Use the formula I = P T R / 100)

 b. A cashier has currency notes of denominations Rs.10, Rs. 50 and Rs. 100. If the amount to be withdrawn is input in hundreds, find the total number of notes of each denomination the cashier will have to give to the withdrawer.

 c. In a town, the percentage of men is 52. The percentage of total literacy is 48.If total percentage of literate men is 35 of the total population; write a program to find the total number of illiterate men and women if the population of the town is 8000.

3. a. Write a program that prints the given 3 integers in ascending order using if - else.

 b. Write a program to calculate commission for the input value of sales amount.

 Commission is calculated as per the following rules:

 i) Commission is NIL for sales amount Rs. 5000.

 ii) Commission is 2% for sales when sales amount is >Rs. 5000 and <= Rs. 10000.

 iii) Commission is 5% for sales amount >Rs. 10000.

 c. A character is entered through keyboard. Write a program to determine whether the character entered is a capital letter, a small case letter, a digit or a special symbol.

 The following table shows the range of ASCII values for various characters.

Characters ASCII values

Characters	ASCII values
A - Z	65 - 90
a - z	97 - 122
0 - 9	48 - 57
Special Symbols	0 - 47, 58 - 64, 91- 96, 123 - 127

4. a. If cost price and selling price of an item is input through the keyboard, write program to determine whether the seller has made profit or incurred loss. Also determine how much profit or loss he incurred in percentage.

 b. An insurance company calculates premium as follows:

 i. If a person's health is excellent and the person is between 25 and 35 years of age and lives in a city and is a male then premium is Rs.4 per thousand and the policy amount cannot exceed Rs.2 lakhs.

 ii. If a person satisfies all the above conditions and is female

then the premium is Rs.3 per thousand and the policy amount cannot exceed Rs.1 lakh.

   iii. If a person's health is poor and the person is between 25 and 35 years of age and lives in a village and is a male then premium is Rs.6 per thousand and the policy cannot exceed Rs. 10000.

   iv. In all other cases the person is not insured.
Write a program to determine whether the person should be insured or not, his/her premium rate and maximum amount for which he/she can be insured.

5. a. Write a program, which takes two integer operands and one operator as input from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, %. Use switch statement)

   b. Write a program to find the grace marks for a student using switch. The user should enter the class obtained by the student and the number of subjects he has failed in. Use the following rules:

     i. If the student gets first class and the number of subjects failed is >3, then no grace marks are awarded. If the number of subjects failed is less than or equal to '3' then the grace is 5 marks per subject.

     ii. If the student gets second class and the number of subjects failed in is >2, then no grace marks are awarded. If the number of subjects failed in less than or equal to '3' then the grace is 4 marks per subject.

     iii. If the student gets third class and the number of subjects failed in is >1, then no grace marks are awarded. If the number of subjects failed in is equal to '1' then the grace is 5 marks per subject.

6. a. Write a program to find the sum of individual digits of a positive integer.

   b. A Fibonacci sequence is defined as follows:
The first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a program to generate the first N terms of the sequence.
Write a program to generate all the prime numbers between 1 and N, where N is a value supplied by the user.

7. a. Write a program to find the largest and smallest number in a given list of integers.

b. Write a program to perform the following:
   i. Addition of two matrices.
   ii. Multiplication of two matrices.

8. a. Write a program that uses functions to perform the following operations:
   i. To insert a sub-string in main string at a specified position.
   ii. To delete N characters from a given string from a specified position.

   b. Write a program to determine whether the given string is palindrome or not.
   c. Write a program to display the position or index in the main string S where the sub string T begins. Display -1 if S does not contain T.
   d. Write a program to count the number of lines, words and characters in a given text.

9. a. Write a program to read list of student names and perform the following operations using functions.
   i. to print list of names
   ii. to sort them in ascending order
   iii. to print the list after sorting.

   b. Write a menu driven program to read list of student names and perform the following operations using array of character pointers.
   i. to insert a student name
   ii. to delete a name
   iii. to print the name

10. Write a program that uses functions to perform the following operations:
   i. Reading a complex number
   ii. Writing a complex number
   iii. Addition of two complex numbers
   iv. Multiplication of two complex numbers
   (**Note:** Represent complex number using a structure.)

11. a. Write a program to accept the elements of the structure as:
   Employee-name,Basic pay
   Display the same structure along with the DA, CCA and Gross salary for 5 employees.
   Note: DA=51% of Basic pay, CCA=Rs.100 consolidated.

b. Define a structure to store employee's data with the following specifications:
   Employee-Number, Employee-Name, Basic pay, Date of Joining
   i. Write a function to store 10 employee details.
   ii. Write a function to implement the following rules while revising the basic pay.
       If Basic pay<=Rs.5000 then increase it by 15%.
       If Basic pay> Rs.5000 and <=Rs.25000 then it increase by 10%.
       If Basic pay>Rs.25000 then there is no change in basic pay.
   Write a function to print the details of employees who have completed 20 years of service from the date of joining.

12. a. Write a program which copies one 'text file' to another 'text file'.
    b. Write a program to reverse the first N characters of a given text file.

(Note: The file name and N are specified through command line.)

13. Write a program to print the output by giving the Customer_ID as an input.

REFERENCE BOOKS:

1. Byron Gottfried and Jitender Kumar *C, Programming with C,* Third Edition, McGraw Hill Education(India) Pvt. ltd, New Delhi, 2016.
2. Pradip Dey and Manas Ghosh, *Programming in C,* Second Edition, Oxford University Press, New Delhi, 2007.

I B. Tech. - II Semester
(16BT1BS02) ENGINEERING PHYSICS
(Common to CSE, CSSE, IT, CE & ME)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Intermediate / senior secondary Physics.

COURSE DESCRIPTION: Lasers; optical fibers; principles of quantum mechanics; band theory of solids; semiconductors; dielectric properties of materials; acoustics of buildings; superconductors; crystallography and nanomaterials.

COURSE OUTCOMES:

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

CO1: Acquire basic knowledge of lasers, optical fibers, quantum mechanics, dielectrics, semiconductors and superconductors, acoustic of buildings, crystallography and nanomaterials.

CO2: Analyze the construction and working of various laser systems, semiconductor devices, various types of optical fibers and its communication system and nano materials properties.

CO3: Gain skills in designing lasers, optical fiber cable, semiconductor devices, acoustically good halls and nanomaterials.

CO4: Develop problem solving skills in engineering context.

CO5: Use relevant techniques for assessing ball milling, pulsed laser deposition, p-n junction and Laser.

DETAILD SYLLABUS:

UNIT–I: LASERS AND FIBER OPTICS (11 Periods)

Lasers: Introduction, characteristics of lasers, spontaneous and stimulated emission of radiation, Einstein's coefficients – condition for amplification, population inversion, Nd:YAG laser, Helium-Neon laser, semiconductor laser and applications of lasers.

Fiber optics: Introduction, principle of optical fiber, acceptance angle, acceptance cone and numerical aperture, classification of optical fibers, optical fiber communication system and applications of optical fibers.

UNIT-II: PRINCIPLES OF QUANTUM MECHANICS AND BAND THEORY OF SOLIDS (07 Periods)

Principles of Quantum Mechanics: Introduction, De-Broglie's hypothesis, Schrödinger's one dimensional wave equation (time independent), significance of wave function, particle in a one dimensional potential box, Fermi-Dirac distribution and effect of temperature (qualitative treatment).

Band Theory of Solids: Electron in a periodic potential, Kronig-Penney model (qualitative treatment), origin of energy bands formation in solids, distinction between conductors, semiconductors and insulators based on band theory.

UNIT-III: SEMICONDUCTORS AND DIELECTRIC PROPERTIES OF MATERIALS (13 Periods)

Semiconductors: Introduction, types of semiconductors, intrinsic carrier concentration, electrical conductivity in semiconductors, drift and diffusion currents, Einstein's relation, Hall effect and its applications, direct and indirect band gap semiconductors, p-n junction, energy band diagram of p-n diode, LED, photo diode and Solar cell.

Dielectric Properties of Materials: Introduction, dielectric constant, electronic, ionic and orientation polarizations (qualitative treatment), local field, frequency dependence of polarizability (qualitative treatment), ferroelectricity.

UNIT-IV: ACOUSTICS OF BUILDINGS AND SUPERCONDUCTIVITY (07 Periods)

Acoustics of Buildings: Introduction, basic requirement of acoustically good hall, reverberation and time of reverberation, Sabine's formula for reverberation time (qualitative treatment), absorption coefficient of sound and its measurement, factors affecting the architectural acoustics and their remedies.

Superconductivity: Introduction, general properties - Meissner effect, penetration depth, Type-I and Type-II superconductors, flux quantization, Josephson effects, BCS theory (qualitative treatment), applications of superconductors.

UNIT-V: CRYSTALLOGRAPHY AND NANOMATERIALS (07 Periods)

Crystallography: Introduction, crystal planes,crystal directions and Miller indices, separation between successive (hkl) planes, X-ray diffraction by crystal planes, Bragg's law- powder method.

Nanomaterials: Introduction, principles of nanomaterials,

properties of nanomaterials, synthesis of nanomaterials by ball milling and pulsed laser deposition and applications of nanomaterials.

Total Periods: 45

TEXT BOOK:

1. P. K. Palaniswamy, *Engineering Physics,* Scitech Publications India Private Limited, 2nd Edition, 2009.

REFERENCE BOOKS:

1. Dr. S. Mani Naidu, *Engineering Physics*, Pearson Education, 1st edition, 2013.

2. M.N. Avadhanulu,P.G.Kshirsagar, *A Textbook of Engineering Physics*, S.Chand & Company Ltd. Revised edition 2014.

3. K. Thyagarajan**,** *Engineering Physics-I,* McGraw-Hill Education India: Pvt.Ltd. 2015.

I B. Tech. - II Semester
(16BT2BS01) TRANSFORMATION TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS
(Common to all Branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE REQUISITE: Intermediate /Senior secondary mathematics

COURSE DESCRIPTION: Fourier series; Fourier integrals and transforms; Laplace transforms; z –transforms; partial differential equations.

COURSE OUTCOMES:

After completion of the course a successful student is able to

CO1: Acquire basic knowledge in
- Fourier series and Fourier transforms
- Fourier integrals
- Laplace transforms and their applications
- z- transforms and their applications
- Solving partial differential equations

CO2: Develop skills in analyzing the
- Properties of Fourier series for a given function
- Partial differential equations through different evaluation methods
- Difference equations through z – transforms
- Engineering systems and processes involving wave forms and heat transfer

CO3: Develop skills in designing mathematical models for
- Problems involving heat transfer and wave forms
- Engineering concepts involving, Fourier transforms, Fourier integrals, Laplace transforms, z-transforms and difference equations

CO4: Develop analytical skills in solving the problems involving
- Fourier series and Fourier transforms
- Laplace transforms
- Z-transforms and difference equations
- Heat transfer and wave motion

CO5: Use relevant transformation techniques for
- Obtaining Fourier transforms for different types of functions
- Laplace transforms
- Z- transforms
- Partial differential equations

DETAILED SYLLABUS:

UNIT- I : FOURIER SERIES   (07 Periods)

Fourier series: Determination of Fourier coefficients, convergence of Fourier series (Dirichlet's conditions), Fourier series of even and odd functions, Half-range Fourier sine and cosine expansions.

UNIT- II: FOURIER INTEGRALS AND FOURIER TRANSFORMS
(08 Periods)

Fourier integral theorem (statement only), Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms –properties, Inverse transform and finite Fourier transforms.

UNIT-III: LAPLACE TRANSFORMS   (12 Periods)

Laplace transforms of standard functions. Properties of Laplace transforms. First and second shifting Theorems. Laplace transforms of derivatives and integrals. Inverse transforms. Convolution theorem (without proof), inverse Laplace transforms by convolution theorem. Laplace transform of periodic functions, Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

UNIT-IV: Z- TRANSFORMS   (09 Periods)

Z – transforms, inverse Z– transforms, damping rule, shifting rule, initial and final value theorems. Convolution theorem (without proof), solution of difference equations by Z– transforms.

UNIT–V: PARTIAL DIFFERENTIAL EQUATIONS (09 Periods)

Formation of Partial differential equations – Solutions of first order linear equations by method of grouping. First and second order equations by method of separation of variables – Solutions of one dimensional Wave equation, Heat equation.

Total Periods: 45

TEXT BOOKS:

1.   T.K.V. Iyengar, B. Krishna Gandhi,S.Ranganadham and M.V.S.S.N. Prasad,*Engineering Mathematics,* vol-1, S. Chand & Company 13/e,2014.

2.   T.K.V. Iyenger, B. Krishna Gandhi, S.Ranganadham and M.V.S.S.N.Prasad, *Mathematical Methods,*S.Chand and Company, 8/e,2013.

REFERENCE BOOKS:

1.   Grewal, B.S., *Higher Engineering Mathematics,*Khanna publishers, Delhi, 42/e,2012.

2.   Kreyszig, E., *Advanced Engineering Mathematics,*John Wiley and Sons, Inc.,9/e,2013.

I B. Tech. - II Semester
(16BT20102) ENGINEERING MECHANICS
(Common to CE & ME)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	4	1	-	4

PRE-REQUISITES: Intermediate Mathematics and Physics.

COURSE DESCRIPTIONS: statics of particles and rigid bodies; support reactions; analysis of perfect frames; friction; centroid, centre of gravity and moment of inertia; kinematics and kinetics.

COURSE OUTCOMES:

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

CO1: Apply the knowledge of engineering mechanics fundamentals to the solutions of basic engineering problems.

CO2: Analyze
- Multi-body systems under equilibrium and dynamic conditions.
- Systems involving dry friction and computing the efficiency of the system of forces in frames under suitable assumptions.
- Sectional properties of surfaces and solids.

CO3: Design sustainable solutions to complex engineering problems using first principles of engineering mechanics.

CO4: Exercise awareness to assess the safety of system related to engineering mechanics.

CO5: Communicate effectively engineering and allied information through free body diagram.

CO6: Sustain interest in engineering mechanics to upgrade knowledge and skills through self learning concepts in mechanics.

DETAILED SYLLABUS:

UNIT–I: STATICS OF PARTICLES **(10 Periods)**

Basic concepts, System of units, System of concurrent coplanar forces in plane, Resultant of forces, Laws of mechanics, Equilibrium of forces, Lami's theorem, Vectorial representation of forces.

UNIT–II: STATICS OF RIGID BODIES **(14 Periods)**

Moment of a force, Varignon's theorem, Moment of a couple, Vectorial representation of moments and couples, Coplanar non-concurrent forces, Equilibrium of rigid bodies, Types of supports and loads, Types of frames, Perfect frame analysis, Method of joints, Method of sections, Principle of virtual work.

UNIT–III: FRICTION **(10 Periods)**

Frictional force, Types of friction, Laws of friction, Co-efficient of friction, Angle of friction, Angle of repose, Cone of friction, Applications: Body on horizontal/inclined plane, Two bodies in contact, Ladder friction, Wedge friction.

UNIT–IV: CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA **(12 Periods)**

Centroids of simple and composite areas, centre of gravity of bodies, Theorems of Pappus and Guldinus, Parallel axis and perpendicular axis theorems, Moment of Inertia of Composite areas, Radius of gyration – Section modulus, Mass Moment of Inertia of simple and composite masses.

UNIT–V: KINEMATICS AND KINETICS **(14 Periods)**

Kinematics of Particles

Rectilinear and Curvilinear motion, Velocity, Acceleration, Motion of a projectile, Relative motion.

Kinetics of Particles and Rigid Bodies

Kinetics of rectilinear motion, Newton's laws of motion, D'Alembert's principle, Work-energy method, Impulse-momentum equation, Kinetics of circular motion, Rotation.

Total Periods: 60

TEXT BOOKS:

1. S. S. Bhavikatti and K. G. Rajashekarappa, *Engineering Mechanics*, New Age International (P) Ltd., 3rd Edition, 2009.

2. J. L. Meriam and L. G. Kraige, *Engineering Mechanics: Statics* (Vol. 1), *Dynamics* (Vol. 2), John Wiley & Sons Ltd., 5th Edition, 2008.

REFERENCE BOOKS:

1. Arthur P. Boresi and Richard J. Schmidt, *Engineering Mechanics - Statics and Dynamics*, Cengage Learning, 1st edition, Indian Edition, 2008.

2. S. Rajasekaran and G. Sankarasubramanian, *Engineering Mechanics – Statics and Dynamics*, Vikas Publishing House Pvt. Ltd., 3rd edition, 2009.

3. K. Vijaya Kumar Reddy and J. Suresh Kumar, *Singer's Engineering Mechanics - Statics and Dynamics*, BS Publications, 3rd edition, 2010.

4. S. Timoshenko, D. H. Young and J. V. Rao, *Engineering Mechanics*, Tata McGraw-Hill Education Pvt. Ltd., Revised 4th edition, Special Indian Edition, 2007.

I B. Tech. - II Semester
(16BT20241) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to CE & ME)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Intermediate Mathematics and Physics.

COURSE DESCRIPTION: Basics of electrical DC and AC circuits; principle of operation and applications of DC machines, transformers, and induction motors; Transducers and measuring instruments; rectifier devices; bipolar transistors and its characteristics.

COURSE OUTCOMES:
After successful completion of this course, the student will be able to:

CO1: Demonstrate knowledge on
- Electrical and electronic circuits.
- Construction and operation of electrical machines, electrical and electronic instruments.

CO2: Analyze various electrical & electronic circuits and different transducers.

CO3: Evaluate the electrical and electronic circuit parameters and performance of electrical machines.

CO4: Select and apply various machines and transducers.

DETAILED SYLLABUS:
UNIT-I: BASICS OF ELECTRICAL ENGINEERING

(10 Periods)

Sources of electricity, basic circuit components, electric field, electric current, potential and potential difference, EMF, electric power, Ohm's law, node, path, loop, branch, resistive networks, inductive networks, capacitive networks, Kirchhoff's laws, series-parallel circuits, nodal analysis, mesh analysis, star-delta and delta-star transformations – problems.

UNIT–II: AC FUNDAMENTALS **(09 Periods)**
Production of alternating voltage, phase and phase difference, phasor representation of alternating quantities, behavior of AC series, parallel and series-parallel circuits, power in AC circuit - problems.

UNIT–III: DC AND AC MACHINES (10 Periods)

DC Machines: Construction and working of a DC Generator and DC motor and their types, EMF equation of a DC generator, torque equation of a DC motor, applications of DC generators and DC motors - problems.

Transformers: Construction and working of a single phase transformer, EMF Equation.

AC Machines: Construction and working of a three phase induction motor, applications of three phase induction motors.

UNIT–IV: TRANSDUCERS AND MEASURING INSTRUMENTS (08 Periods)

Transducers, Basic requirements of transducers, passive transducers - strain gauge, thermistor, Hall-Effect transducer, LVDT, and active transducers, Piezoelectric and thermocouple, Load cells, Data loggers, Data acquisition system (overview and concept only), Digital voltmeters, Digital ammeter, Digital multi-meters (elementary concepts only).

UNIT–V: RECTIFIER CIRCUITS AND BIPOLAR JUNCTION TRANSISTORS (08 Periods)

Rectifier Circuits: DC voltage and current, Peak Inverse Voltage (PIV), ripple factor, efficiency and regulation of half wave and full wave rectifiers.

Bipolar Junction Transistors: Formation of PNP / NPN junctions, Transistor as an amplifier, need for biasing, single stage CE amplifier.

Total Periods: 45

TEXT BOOKS:
1. V.K. Mehta and Rohit Mehta, *Principles of Electrical and Electronics Engineering,* 2nd edition, S.Chand & Sons, New Delhi, 2007.
2. M.S. Naidu and S. Kamakshaiah, *Introduction to Electrical Engineering*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

REFERENCE BOOKS:
1. Theraja B.L & Theraja A.K, *A Text Book of Electrical Technology*, Vol-1, S.Chand, New Delhi, 2009.
2. A. K. Sawhney, *Electrical & Electronics Measurement and Instrumentation*, Dhanpat Rai & Co.(P) Ltd, New Delhi, 15th edition, 2014.
3. K. Lal Kishore, *Electronic Devices and Circuits,* BS Publications, Hyderabad, 3rd edition, 2008.

I B. Tech. - II Semester
(16BT20301) ENGINEERING MATERIALS
(Mechanical Engineering)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Intermediate Physics, Engineering Chemistry.

COURSE DESCRIPTION: Classification, properties and applications of materials; atomic and crystal structure of metals; formation of alloys; structure and properties of ferrous and non-ferrous metals; properties and applications of ceramics and composite materials; testing of materials.

COURSE OUTCOMES:

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

CO1: Gain basic knowledge on engineering materials such as,
- Classification.
- Structure, properties and applications.
- Various testing procedures.

CO2: Analyze
- Material microstructure.
- Characterization and properties of various materials.

CO3: Design a crystallographic model of a material at microscopic level.

CO4: Use modern material testing instruments such as ultrasonic flaw detector, Radiography.

CO5: Identify the impact of materials on the environmental issues.

DETAILED SYLLABUS:

UNIT-I: ENGINEERING MATERIALS AND PROPERTIES

(9 Periods)

Introduction, classification and applications of engineering materials. Mechanical Properties: tensile strength, compressive strength, ductility, malleability, hardness, toughness, brittleness, impact strength, fatigue, creep resistance. Physical properties: density, melting point, specific heat, corrosion resistance. Thermal properties: Thermal conductivity, Thermal expansion and Specific heat. Electrical properties and Magnetic properties.

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UNIT-II: STRUCTURE OF MATERIALS (09 Periods)

Primary and secondary bonding in materials, space lattice, unit cell, structure of materials: simple cubic, body centered cubic, face-centered cubic, hexagonal closed-pack. Crystal defects: point, line, planar, and volume, grain and grain boundaries, effect of grain boundaries on properties of metal/alloys, determination of grain size.

UNIT-III: FERROUS, NON- FERROUS METALS AND THEIR ALLOYS (09 Periods)

Ferrous metals and its alloys: Structure, properties and applications of plain carbon steel, low carbon steel, Hadfield manganese steel, stainless steel, and tool steel. Structure, properties and applications of grey cast iron, white cast iron, malleable cast iron, spheroidal cast iron, alloy cast iron.

Non-ferrous metals and its alloys: Properties and applications of copper, Tin, Lead, Aluminum, Titanium and their alloys and super alloys.

UNIT-IV: CERAMICS AND COMPOSITE MATERIALS (09 Periods)

Ceramics: Properties and applications of crystalline ceramics, glasses, cermets, abrasive Materials.

Composite materials: Introduction, types of matrices and reinforcement, Polymer-Matrix Composites: Glass-Fiber Reinforced Plastic, Carbon-Fiber Reinforced Plastic, Metal-Matrix Composites , Ceramic-Matrix Composites.

UNIT-V: TESTING OF MATERIALS (09 Periods)

Destructive testing: tensile, compressive, shear, hardness and impact tests.

Non-destructive testing: gamma ray detection, magnetic particle inspection, eddy current inspection, die penetration, radiography and ultrasonic testing.

Total Periods: 45

TEXT BOOKS:
1. William. D. Callister, *Materials Science and Engineering-An Introduction*, John Wiley and sons, 8th edition, 2009.
2. Serope Kalpakjian, Steven R Schmid, *Manufacturing Engineering and Technology*, Pearson Publications, 6th Edition, 2009.

REFERENCE BOOKS:
1. Sidney H Avner, *Introduction to Physical Metallurgy,* Tata Mc Graw Hill, 2nd edition, 2009.
2. V.D. Kodigre, *Material Science and Metallurgy*, Everest Publishing House, 12th edition, 2002.
3. V. Raghavan, *Physical Metallurgy: Principles and Practices*, PHI, 3rd edition, 2015.

I B. Tech. - II Semester
(16BT1BS32) **ENGINEERING PHYSICS LAB**
(Common to CSE, CSSE, IT, CE & ME)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES:　Intermediate / senior secondary Physics.

COURSE DESCRIPTION:

Characteristics of p-n junction diode, Photodiode, LED, and semiconductor laser diode. Experimental determination of carrier concentration and energy gap of a semiconductor material, wave length of a laser source, size of fine particle, numerical aperture and acceptance angle of optical fiber. Determination of frequency of electrically vibrating tuning fork and A.C source using A.C sonometer, magnetic field along axial line of a current carrying coil and rigidity modulus of material of a wire using torsional pendulum.

COURSE OUTCOMES:

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

CO1: Acquire basic knowledge about semiconductor materials, magnetic materials and lasers.

CO2: Acquire analytical skills in the estimation of carrier concentration of semiconductor materials and characterization of p-n junction.

CO3: Develop skills in designing electronic circuits using semiconductor components.

CO4: Acquire skills to use instrumental techniques in A.C sonometer and Melde's experiment.

CO5: Apply diffraction techniques for determination of size of tiny particles and wave length of lasers.

LIST OF EXPERIMENTS

Conduct a minimum of any **Ten** of the following experiments.

1. Determination of wavelength of a laser source using Diffraction Grating.
2. Determination of particle size by using a laser source.

3. Determination of Numerical aperture and acceptance angle of an optical fiber.
4. Melde's experiment - transverse & longitudinal modes.
5. Magnetic field along the axis of a current carrying coil-Stewart and Gee's method.
6. Calculation of A.C frequency using sonometer.
7. I-V Characteristics of a p-n Junction diode.
8. Energy gap of a material of a p-n Junction.
9. Characteristics of LED source.
10. Characteristics of Photo diode.
11. Hall Effect.
12. Determination of rigidity modulus of the material of the wire using torsional pendulum.

I B. Tech. - II Semester
(16BT20251) ELECTRICAL AND ELECTRONICS ENGINEERING LAB
(Mechanical Engineering)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Physics.

COURSE DESCRIPTION: Verification of Kirchhoff's laws; study performance of AC/DC motors; various tests on DC shunt motors; brake test on 3-phase induction motors; V-I characteristics of diode, Half wave rectifier with/without capacitive filter; bipolar junction transistor amplifier.

COURSE OUTCOMES:

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

CO1: Employ knowledge acquired to determine appropriate type of electrical machine or circuit to be used in a given situation.

CO2: Analyzing the performance of electrical machines, rectifiers and amplifiers.

CO3: Develop skills in selecting and developing suitable rectifiers and amplifiers for a specific use.

CO4: Function effectively as individual and as a member in a team.

CO5: Communicate effectively in both oral and written forms.

LIST OF EXPERIMENTS
PART A: ELECTRICAL ENGINEERING

1. Verification of Kirchhoff's laws.
2. Study of DC shunt motor starter.
3. Swinburne's test on DC shunt machine (Predetermination of efficiency of a given DC shunt machine working as motor and generator).
4. Speed control of DC shunt motor by
   a) Armature Voltage control
   b) Field flux control method.
5. Brake test on DC shunt Motor.
6. Magnetization characteristics of DC shunt generator.

Determination of critical field resistance.
7. OC and SC tests on single phase transformer (Predetermination of efficiency and regulation at given power factors).
8. Brake test on 3-phase Induction motor (Determination of performance characteristics).

(**Note:** Student shall perform minimum of **Six** experiments)

PART B: ELECTRONICS ENGINEERING
1. V–I characteristics of p-n junction Diode.
2. Half wave rectifier without capacitive filter.
3. Half wave rectifier with capacitive filter.
4. Full wave rectifier without capacitive filter.
5. Full wave rectifier with capacitive filter.
6. Input and output characteristics of transistor in Common Emitter (CE) configuration.
7. Frequency response of a single stage CE amplifier.
8. Sinusoidal signal generation using RC phase shift oscillator circuit.

(**Note:** Student shall perform minimum of **Six** experiments)

I B. Tech. - II Semester
(16BT20331) ENGINEERING WORKSHOP PRACTICE
(Common to CE & ME)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: None

COURSE DESCRIPTION: Knowledge on various workshop hand and power tools; utilization in different manufacturing trades such as carpentry, fitting, house wiring, sheet metal forming, foundry; overview of metal cutting processes, plumbing and welding through live demonstrations.

COURSE OUTCOMES:

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

CO1: Acquire knowledge on utilization of hand and power tools for engineering applications.

CO2: Employ analytical skills for the production of a component for real time applications.

CO3: Design and model different prototypes in the carpentry, fitting and sheet metal operations.

CO4: Comprehend the usage of modern power tools.

CO5: Abide by workshop safety regulations and adopt environmentally safe practices.

CO6: Engage in self study for solving engineering related problems.

DETAILED SYLLABUS:

1. **FITTING:** Introduction, types of fitting tools: holding tools, marking and measuring tools, cutting tools, finishing tools and miscellaneous tools, fitting operations, safety precautions, care and maintenance of hand tools.
   EXERCISES:
   - Square Mating
   - V- Mating
   - Half Round Mating
   - Dovetail Mating.

2. **CARPENTRY:** Introduction, types of wood, carpentry tools, wood working techniques, types of joints, safety precautions, care and maintenance of tools.
   EXERCISES:
   - Cross lap Joint
   - Briddle Joint
   - Dovetail Joint
   - Mortise and Tenon Joint.

3. **SHEET METAL FORMING:** Introduction, sheet metal materials, hand tools, sheet metal fabrication, safety and precautions.
   EXERCISES:
   - Fabrication of Tray
   - Fabrication of Square vessel
   - Fabrication of Funnel
   - Fabrication of Cylinder

4. **WIRING**: Introduction, elements of wiring, wiring methods, earthing, electrical fittings and accessories, types of wires and colors, safety and precautions.
   EXERCISES:
   - One Lamp Controlled by one One- way Switch
   - Two Lamps Controlled by one One-Way Switch in series/ parallel
   - One Lamp Controlled by two Two- way Switches (Stair case wiring)
   - Tube Light Connection

5. **FOUNDRY:** Introduction, moulding sand, properties of moulding sand, types of patterns and pattern , materials, foundry tools, safety and precautions.
   EXERCISES:
   - Mould Preparation with single piece pattern (cube)
   - Mould Preparation with single piece pattern (stepped pulley)
   - Mould Preparation with Split piece Pattern (Tumble)
   - Mould Preparation with Split piece Pattern (pipe bent)

6. THEMES FOR DEMONSTRATION: Machine shop, Plumbing, Welding and Power Tools.

Note: Student shall perform any **Two** exercises from each trade.

Total Periods: 42

REFERENCE BOOKS:

1. P.Kannaiah and K.L.Narayana, *Workshop Manual*, SciTech Publishers, 2009.
2. K. Venkata Reddy, *Workshop Practice Manual*, BS Publications, 2008.
3. V. Ramesh Babu, *Engineering Workshop Practice*, VRB Publishers Private Limited, 2009.

I B. Tech. - II Semester
(16BT20332) MATERIALS SCIENCE LAB
(Mechanical Engineering)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Intermediate Physics, Engineering Chemistry

COURSE DESCRIPTION: Characterization of microstructures of steels, cast irons and non-ferrous metals; heat treatment procedures; data acquisition and recording; grain size analysis; phase segmentation; non-destructive tests; metal powder preparation.

COURSE OUTCOMES:

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

CO1: Acquire knowledge in preparing metallographic specimen and various non-destructive testing methods.

CO2: Analyze the material for
- Material Microstructure.
- Phase distribution.
- Grain size.

CO3: Model appropriate material suitable for engineering applications.

CO4: Use the advanced software testing tool 'Material Plus' for detailed characterization of metal.

CO5: Choose acceptable engineering material for societal and industrial needs.

LIST OF EXPERIMENTS

1. Study of metallurgical instruments & microscope

2. a) Preparation of specimen using cold setting die

   b) Preparation of specimen using hydraulic press

3. Preparation and study of the microstructure of cast irons

4. Preparation and study of the microstructure of carbon steels

5. Preparation and study of the microstructure of Non-Ferrous alloys

6. a) Study of the microstructures of heat treated steels

   b) Measurement of hardness of heat treated and untreated steels

7. Determination of hardenability of steel by Jominy End Quench Test

8. Determination of grain size, porosity and phase distribution of specimens (any four materials) by Material Plus software

9. Visual Inspection

10. Ultrasonic flaw detection test

11. Magnetic particle inspection

12. Die-penetration test

13. Eddy current testing

14. Preparation of metal powders by ball milling machine

15. Compaction of powders

(**Note:** Student shall perform minimum of **Twelve** experiments.)

II B. Tech. – I Semester
(16BT3BS01) PROBABILITY DISTRIBUTIONS AND STATISTICAL METHODS
(Common to CE, ME, CSE, IT, and CSSE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE -REQUISITE: Course on Intermediate/Senior Secondary Mathematics

COURSE DESCRIPTION: Random variables; mathematical expectations; probability distributions; correlation and regressions; statistical quality control; sampling distributions; tests for small and large samples and their significances.

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

CO1: Acquire basic knowledge in
- Probability distributions, correlation and regressions
- Statistical quality control and testing of hypotheses
- Simple linear regression
- Tests of significance for small and large samples

CO2: Develop skills for analyzing the data with
- Mathematical expectations for realistic results
- Probability distributions for practical situations.
- Control charts of statistical quality control
- Correlation and regression concepts
- Suitable tests of significance for practical situations.

CO3: Develop skills in designing
- Probability distributions
- Limitations of statistical quality control
- Control charts,
- X, R, np, and c charts

CO4:   Develop analytical skills forsolvingproblems involving
- Probability distributions, means,variances and standard deviations
- Statistical techniques employed for quality
- Sampling techniques for decision making
- Tests of significances for small and large samples

CO5: Use relevant probability and statistical techniques for
- Mathematical expectations of desired results
- Fitting probability distributions for experimental data.
- Quality control and testing of hypothesis.

DETAILED SYLLABUS:

UNIT - I: RANDOM VARIABLE AND MATHEMATICAL EXPECTATIONS (09 Periods)

Random Variables: Discrete and Continuous random variables, Distribution function of random variable, Properties, Probability mass function, Probability density function, Mathematical expectation, Properties of Mathematical expectation, Mean and Variance.

UNIT - II: PROBABILITY DISTRIBUTIONS (09 Periods)

Discrete Distributions: Binomial and Poisson Distributions, Mean, variance and standard deviations.

Continuous Distributions: Normal Distribution, Mean, Variance and properties.

UNIT - III: CORRELATION, REGRESSION AND STATISTICAL QUALITY CONTROL (09 Periods)

Definition of correlation, correlation coefficient, Rank correlation. Simple linear regression, regression lines and properties.

Introduction, advantages and limitations of statistical quality control, Control charts, specification limits, $\overline{X}$, R, np and c charts.

UNIT - IV: SAMPLING DISTRIBUTIONS AND TEST OF SIGNIFICANCE FOR LARGE SAMPLES (09 Periods)

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Population and Sample, Parameter and Statistic, Sampling Distribution of Statistic, Standard Error of Statistic, Null and Alternative Hypothesis, Type I and II errors, Level of Significance, Critical region, Degrees of freedom. Tests of significance for proportions and means.

UNIT - V: TEST OF SIGNIFICANCE FOR SMALL SAMPLES
(09 Periods)

Student's t-test: single mean, difference of means, F-test for equality of population variance, Chi-Square Test for Goodness of fit, contingency table, Chi-Square Test for Independence of Attributes.

Total periods: 45

TEXT BOOKS:

1. T.K.V. Iyengar, B. Krishna Gandhi, S.Ranganatham and M.V.S.S.N. Prasad, *Probability and Statistics*, S. Chand & Company, 4/e, 2013.

2. S.P.Gupta, *Statistical Methods*, Sultan and Chand, New Delhi, 28/e, 2005.

REFERENCE BOOKS:

1. S.C.Gupta and V.K.Kapoor, *Fundamentals of Applied Statistics*, Sultan and Chand,New Delhi,11/e, 2004.

2. Shahnaz Bathul, *A text book of Probability and Statistics*, Ridge Publications, 2/e,2007.

II B.Tech. - I Semester
(16BT30301) ENGINEERING METALLURGY

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Engineering Materials.

COURSE DESCRIPTION: Extraction of metals from the ores; Different melting techniques; Phase diagrams; Heat treatment procedures and their influence on Mechanical properties; Surface hardening methods; Modern material characterization techniques; Production of metal powders.

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

CO1: Demonstrate the knowledge of engineering metallurgy in extraction of materials by various melting techniques.

CO2: Analyze the structures of various metals influencing various engineering applications.

CO3: Design a suitable heat treatment method to endow required mechanical behavior as per industrial requirements.

CO4: Interpret the data on microstructure of materials using phase diagram and modify the microstructure and properties using different heat treatments.

CO5: Select modern material characterization techniques for analyzing the properties of various materials.

CO6: Identify hazardous substances in metallurgical production and source of environment pollution and propose measures to protect the environment.

DETAILED SYLLABUS:

UNIT – I: MELTING OF METALS   **(08 Periods)**

Introduction, Ores of various metals, Melting of iron, Blast furnace, Cupola furnace, Puddling furnace, Melting of steel, Bessemer converter process, L-D process, Basic open hearth process, Electric furnace Melting of super alloys, Vacuum induction melting, Vacuum arc remelting.

UNIT – II: PHASE DIAGRAMS   **(10 Periods)**

Cooling curve of pure metals and alloys, phase, Phase diagram, Gibbs's phase rule, Hume Rothery rules, binary isomorphous system, binary eutectic alloy system (Lead-Tin System),invariant Reactions- Eutectic, Eutectoid, Peritectic, Peritectoid; Iron-Iron Carbide phase diagram, Effect of alloying elements on Iron-Iron carbon system.

UNIT – III: HEAT TREATMENT OF STEELS   **(09 Periods)**

Introduction, Annealing, Full annealing, Isothermal annealing, Spheroidal annealing, Process annealing, Normalizing, Hardening, Age hardening, Tempering, Austempering, Martempering, Sub zero treatment, TTT diagram, CCT diagrams.

UNIT – IV: SURFACE HARDENING METHODS AND MATERIAL CHARACTERIZATION TECHNIQUES   **(09 Periods)**

Surface hardening methods: Introduction, Carburizing, Nitriding, Cyaniding, Carbonitriding, Flame and Induction hardening

Material characterization techniques: Introduction, Steps in metallographic specimen preparation, Optical microscope, Scanning electron microscope, Transmission electron microscope, X-ray diffraction.

UNIT - V: POWDER METALLURGY   **(09 Periods)**

Introduction, Methods of production of metal powders, Atomization process, Electrolysis, Reduction, Mechanical Alloying, Particle size, Shape and distribution, Mixing, Blending, Compacting, Hot Isostatic pressing, Cold Isostatic pressing, Sintering, Applications, Advantages and limitations of powder metallurgy.

Total Periods: 45

TEXT BOOKS:

1. William. D. Callister, *Materials Science and Engineering-An Introduction*, John Wiley and sons, 8th Edition, 2009.

2. P.N.Rao, *Manufacturing Technology*, Vol.1, TMH, 4th Edition, 2013

REFERENCE BOOKS:

1. Avner, *Introduction to Physical Metallurgy*, Tata Mc Graw Hill, 2nd Edition, 2009.

2. Kodigre V D, *Material Science and Metallurgy*, Everest Publishing House, 12th Edition, 2002.

3. V. Raghavan, *Physical Metallurgy: Principles and Practices*, PHI, 3rd Edition, 2015.

II B. Tech. – I Semester
(16BT30302) KINEMATICS OF MACHINERY

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Engineering Mechanics and Computer Aided Engineering Drawing.

COURSE DESCRIPTION: Basic concepts and description of various plane mechanisms; Calculation of Displacement; Velocity and acceleration of simple plane mechanisms; Straight line mechanisms; Steering mechanisms; Hook's joint; Preparation of cam profiles; Concepts of Gears and Gear trains.

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

CO1: Demonstrate various mechanisms and choose one best suited for a given situation.

CO2: Analyze a given mechanism and find motion characteristics.

CO3: Design suitable gear train mechanism for specific requirement.

CO4: Investigate problems associated with machine components such as gears, gear trains.

CO5: Apply appropriate techniques to design cam profiles.

CO6: Integrate the kinematic mechanisms to the societal needs within realistic constraints.

DETAILED SYLLABUS:

UNIT - I: MECHANISMS AND MACHINES   (08 Periods)

Elements or Links, Classification- Rigid, Flexible and Fluid link; Types of kinematic pairs- Sliding, Turning, Rolling, Screw and Spherical pairs, Lower and Higher pairs, Closed and Open pairs; Constrained motions- Completely, Partially or successfully and incompletely constrained motion; Kinematic chain, Types of joints- Binary, Ternary and Quaternary joints; Number of Degrees of Freedom, Kutzbach and Grubler's Criteria, Inversions of plane mechanisms- Quadric cycle, Single slider and Double slider crank chains.

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UNIT - II: VELOCITY AND ACCELERATION ANALYSIS OF MECHANISMS (08 Periods)

Instantaneous center of rotation, Centrode and Axode, Relative motion between two bodies, Kennedy theorem (Three centers in line), Instantaneous center method to determine angular velocity of links and linear velocity of point, Relative velocity method to determine velocity and acceleration diagrams for

four bar mechanism, Slider-crank mechanism and its inversions, Coriolis component of acceleration.

UNIT - III: STRAIGHT LINE, STEERING GEAR MECHANISMS AND HOOK'S JOINT 10 Periods)

Pantograph, Exact Straight Line Motion Mechanisms- Peaucellier, Hart and Scott Russell's mechanism; Approximate Straight Line Motion Mechanisms- Modified Scott Russell's mechanism, Watt's, Grasshopper, Tchebicheff's and Robert mechanisms; Steering mechanisms, Condition for correct steering, Davis Steering gear and Ackerman steering gear mechanisms, Single and double Hooke's joints.

UNIT - IV: GEARS AND GEAR TRAINS (11 Periods)

Friction wheels and toothed gears, Types, Law of gearing, Sliding velocity of teeth, Forms of teeth- Cycloidal, Involute profiles; Expressions for path of contact and arc of contact, Contact ratio, Phenomena of interference, Condition for minimum number of teeth to avoid interference, Gear trains - Simple, Compound, Reverted and Epicyclic gear train; Compound Epicyclic Gear Train (sun and planet wheel), Differential gear box for automobile.

UNIT - V: CONSTRUCTION OF CAM PROFILE (08 Periods)

Introduction to cams and followers, Types, Terminology, Types of follower motion, Cam profile- For uniform velocity, SHM, Uniform acceleration and retardation of Knife edge, Roller followers (axis of follower passes through the axis of cam shaft and offset), Maximum velocity and maximum acceleration during outward and return stroke.

Total Periods: 45

TEXT BOOKS:

1. S. S. Rattan, *Theory of Machines and Mechanisms*, Tata McGraw Hill Education, 4th Edition, 2016.
2. R.S. Khurmi, *Theory of machines, S.Chand Publications*, 14th Revised Edition, 2012

REFERENCE BOOKS:

1. Ballaney. P. L., *Theory of Machines and Mechanisms*, Khanna Publishers, 2005
2. Joseph Edward Shigley and John Joseph Uicker,Jr., *Theory of Machines and Mechanisms*, MGH, 4th Edition, New York, August 2013.
3. Bevan T, *Theory of Machines*, CBS Publishers and Distributors, New Delhi, 2002.

II B.Tech. – I Semester

(16BT30303) MANUFACTURING TECHNOLOGY

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Engineering Materials.

COURSE DESCRIPTION: Manufacturing Processes; Foundry and Special Casting Processes; Joining Processes; Gas Welding; Electric Arc Welding; Resistance Welding; Metal Forming Processes; Sheet Metal Operations and Plastic Processing.

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

CO1: Demonstrate the knowledge required for Manufacturing Process suitable for fabricating a product.

CO2: Analyze the components of moulds and select materials and allowances of patterns used in casting.

CO3: Design Core, Core Print and Gating System in Metal Casting Processes.

CO4: Conduct investigations on manufacturing process for a particular application.

CO5: Use methodology to manufacture components with less human effort.

DETAILED SYLLABUS:

UNIT – I: FOUNDRY   (09 Periods)

Introduction, Sand mould making procedure, Types of Patterns, Pattern Materials, Pattern Allowances, Gates and Risers, Design of Gating systems, Properties of Moulding Sand, Testing of Moulding Sand, Moulding Machines, Types of Cores.

UNIT – II: SPECIAL CASTING PROCESSES   (09 Periods)

Introduction, Special Casting Processes – Shell Moulding, Precision Investment Casting, Permanent Mould Casting, Full Mould Casting, Die Casting, Centrifugal casting, Continuous Casting; Cleaning and Finishing of Castings - Inspection and Testing of Castings, Casting Defects .

UNIT – III: METAL FORMING PROCESSES AND SHEET METAL OPERATIONS (09 Periods)

Metal forming processes: Introduction, Hot Working and Cold Working, Forging, Extrusion – Direct, Indirect and Tube Extrusion; Rolling – Types of Rolling Mills; Drawing – Rod, Wire and Tube Drawing.

Sheet Metal Operations: Shearing operations, Types of dies - Progressive Die, Compound Die and Combin Magnetic Pulse Forming, Electro-Hydraulic Forming.

UNIT – IV: METAL WELDING PROCESSES (09 Periods)

Introduction, Classification of Welding Processes - Arc Welding, TIG Welding, MIG Welding, Submerged Arc Welding; Gas Welding Process – Types of Flames; Resistance Welding – Spot Welding, Seam Welding; Thermit Welding, Electron Beam Welding, Laser Beam Welding, Ultrasonic Welding, Welding Defects - Causes and Remedies; Destructive and Non-destructive Testing of Welds, Soldering and Brazing.

UNIT – V: PLASTIC PROCESSING (09 Periods)

Introduction, Plastics – Properties of Plastics, Additives in Plastics; Types of Plastics- Thermoforming Plastics, Thermosetting Plastics; Injection Moulding, Blow Moulding, Compression Moulding, Transfer Moulding, Extrusion Process, Calendering, Casting of Plastics, Sheet Forming Processes.

Total Periods: 45

TEXT BOOKS:

1. P.N.Rao, *Manufacturing Technology*, Vol.1, TMH, 4th Edition, 2013

2. Kalpakjian, Serope, *Manufacturing Engineering and Technology*, Pearson Education, 7th Edition, 2014.

3. Hazra Choudary S.K. and Hazra Choudary A.K., *Elements of Workshop Technology*, Vol I, Media Promoters, 12th Edition, 2007.

REFERENCE BOOKS:

1. R.K.Jain, *Production Technology*, Khanna Publishers, 17th Edition, 2010.

2. Rosenthal, *Principles of Metal Castings*, McGraw-Hill Professional Publishing, 3rd Edition, 2013.

3. Mikell P.Groover, *Fundamentals of Modern Manufacturing, Materials, Processes and Systems*, John Wiley and Sons, 9th Edition, 2007.

II B.Tech. – I Semester
(16BT30304) STRENGTH OF MATERIALS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Engineering Mechanics.

COURSE DESCRIPTION: Analysis of stresses and strains of mechanical and structural components; action of shear; bending and torsional stresses; deflection of beams due to axial and transverse loadings; thin and thick walled pressure vessels.

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

CO1: Demonstrate the basic behavior of materials when subject to external influences.

CO2: Analyze the internal and external behavior of members during loading.

CO3: Develop the solution for complex loading conditions by simplifying under suitable assumptions.

CO4: Investigate the behavioral changes of materials and provide valid conclusion.

CO5: Relate the contextual knowledge to access safety issues.

CO6: Communicate the mechanical properties under loading through graphical representation.

DETAILED SYLLABUS:

UNIT - I: SIMPLE STRESSES AND STRAINS (10 Periods)

Types of Stresses, Strains, Hooke's law, Stress–Strain diagram, Working Stress, Factor of safety, Lateral strain, Poisson's ratio, Volumetric strain, Elastic Moduli and relationship between them, Bars of Varying section, Composite bars, Temperature stresses, Strain energy.

UNIT - II: SHEAR FORCE AND BENDING MOMENT
(08 Periods)

Concept of shear force and bending moment, S.F and B.M. diagrams for cantilever, Simply supported, Over hanging beams subjected to Point loads, Uniformly distributed loads, Uniformly varying loads and combination of these loads, Point of contraflexure.

UNIT - III: BENDING, SHEAR AND TORSIONAL SHEAR STRESSES **(13 Periods)**

Theory of simple bending, Bending equation, Determination of flexural stresses for simple cases, Section modulus, Shear stress formula, Shear stress distribution across various beams & sections - Rectangular, Circular, Triangular, I, T sections; Theory of pure torsion, Torsion Equation, Torsional moment of resistance, Polar section modulus.

UNIT - IV: DEFLECTION OF BEAMS **(07 Periods)**

Relationship between curvature, slope and deflection, Slope and deflection of cantilever and simply supported beams by Double Integration method and Macaulay's method, Principal stresses, Mohr's circle.

UNIT - V: PRESSURE VESSELS **(07 periods)**

Thin seamless cylindrical shells, Derivation of formula for longitudinal and circumferential stresses, Volumetric strain, Thin spherical shells, Thick cylinders under internal and external pressure.

Total Periods: 45

TEXT BOOKS:

1. S.Ramamrutham, R.Narayanan, *Strength of Materials*, Dhanpat Rai Publications,14th Edition, 2011.
2. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, *Mechanics of Materials*, Laxmi Publications, Revised Edition, 2017.

REFERENCE BOOKS:

1. James M.Gere, Stephen Timoshenko, *Mechanics of Materials*, CBS Publications, 2nd Edition, 2004.
2. Beer, ýJohnston & Dewolf, *Mechanics of Materials*,Tata McGraw-Hill Education, 3rd Edition, 2004.
3. R.K.Rajput, *Strength of materials*, S.Chand Publications, Revised Edition, 2006.

II B. Tech. — I Semester

(16BT30305) THERMODYNAMICS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Engineering Physics and Engineering Chemistry.

COURSE DESCRIPTION: Thermodynamic system; Energy interactions; Heat and work Transfer in flow and non- flow systems; Laws of thermodynamics; Reversible and irreversible processes; Entropy; Equation of state; Pure substance and Gas power cycles.

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

CO1: Demonstrate the knowledge of thermodynamic systems, properties, laws of thermodynamics, entropy, pure substance and gas power cycles.

CO2: Identify, formulate and analyze various thermodynamic systems and provide analytical and numerical solutions.

CO3: Design and develop the solutions for the thermodynamic systems to achieve the required physical process parameters.

CO4: Conduct investigations and address the complex problems on availability, entropy and gas power cycles.

CO5: Use thermodynamic laws (exergy analysis) in estimating the performance of heat engines.

DETAILED SYLLABUS:

UNIT - I: BASIC CONCEPTS OF THERMODYNAMICS

(08 Periods)

Microscopic and macroscopic point of view, Thermodynamic systems, Control volume, Thermodynamic properties, Processes, Cycle, Homogeneous and Heterogeneous systems, Thermodynamic equilibrium, Quasi – static process, Concept of continuum, Work transfer and Heat transfer, Point and path function, Zeroth law of thermodynamics.

UNIT - II: FIRST LAW AND SECOND LAW OF THERMODYNAMICS (10 Periods)

First Law of Thermodynamics: First law for a closed system undergoing a cycle, First law for a closed system undergoing a change of state, Limitations of first Law, Perpetual motion machine (PMM1) of first kind, Energy a property of system, First law applied to a flow process - steady flow energy equation (SFEE).

Second Law of Thermodynamics: Energy reservoir, Kelvin-planck and Clausius statements of second law and their equivalence, PMM of second kind, Heat engine, Refrigerator, Heat pump, Reversibility and Irreversibility, Carnot cycle, Carnot's theorem, Absolute thermodynamics temperature scale.

UNIT - III: ENTROPY AND AVAILABILITY (09 Periods)

Entropy: Introduction, Clausius theorem, Clausius inequality, Entropy as a property, Principle of entropy increase and applications, Third law of thermodynamics.

Availability: Availability and irreversibility, Available Energy, Maximum Work in a Reversible Process, Availability in Non - Flow and Flow Processes.

UNIT - IV: PROPERTIES OF PURE SUBSTANCES, GASES AND GAS MIXTURES (09 Periods)

Properties of pure substances: Introduction, P-V, P-T and T-S Diagrams for a Pure Substance, Quality and Dryness Fraction, Use of Steam Tables and Mollier Chart for thermodynamic properties.

Properties of gases and gas mixtures: Ideal gas, equation of state, Mole Fraction, Mass fraction, Gravimetric and volumetric Analysis, Dalton's Law of partial pressure, Equivalent Gas constant and Molecular Internal Energy, Enthalpy, Specific Heats and Entropy of Mixture of perfect Gases and Vapour.

UNIT - V: GAS POWER CYCLES (09 Periods)

Air standard cycles - Stirling cycle, Ericsson cycle, Joule cycle, Atkinson cycle, Lenoir cycle, Otto cycle, Diesel cycle and Dual cycle; Comparison of Otto, Diesel and Dual cycles.

Total Periods: 45

TEXT BOOKS:

1. P. K. Nag, *Engineering Thermodynamics*, TMH, 5th Edition, 2013.
2. Chatttopadhyay, *Engineering Thermodynamics*, Oxford Publishers, 1st edition, 2011.

REFERENCE BOOKS:

1. Yunus Cengel & Boles, *Thermodynamics–An Engineering Approach*, TMH, 8th Edition, 2015
2. Dr.R.Yadav, *Fundamentals of Engineering Thermodynamics*, Central publishing House, 7th Edition, 2004.

Note: Steam Tables with Mollier Chart shall be supplied during examination.

II B.Tech. - I Semester
(16BT30331) COMPUTER AIDED MACHINE DRAWING LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Course on Computer Aided Engineering Drawing.

COURSE DESCRIPTION: Principles of machine drawing; Sectional views; Tolerances; Thread profiles; Bolted joints; Locking arrangements for nuts; Foundation bolts; Keys; Assembling and Disassembling; Part drawing; .

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

CO1. Read and infer a given CAD drawing.

CO2. Analyze features on a drawing part.

CO3. Develop suitable drawing views to represent part drawings of different machine parts in CAD software.

CO4. Investigate the requirements of complex components and interpret the implications of drawings of machine components.

CO5. Apply appropriate techniques, resources to complex engineering activities for modeling machine components with understanding of limitations.

CO6. Function effectively as an individual and as a member of team to combine various part components into a single assembly.

CO7. Communicate about the assemble and part drawings through the computer aided drawings.

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LIST OF EXPERIMENTS

Any Twelve Exercises are to be conducted and three from each section.

1. **Exercises on machine drawing conventions using drafting software.** (Any three exercises out of five)

    - Conventional representation of materials.

    - Conventional representation of machine components.

    - Conventional representation sectional views.

    - Conventional representation of limits, Fits and tolerances-form and positional tolerances and machining symbols.

    - Conventional representation of dimensioning on the drawings.

2. **Exercises on drawing of machine elements and simple parts using drafting software.**

    (Any three exercises out of five)

    - Types of thread profiles-Square, Metric, ACME, Worm.

    - Bolted joints-Hexagonal bolt and nut, Square bolt and nut.

    - Locking arrangements for nuts-Locking by split pin, castle nut.

    - Foundation bolts- Eye, Bent, Rag foundation bolts.

    - Keys-Saddle key, Sunk key, Woodruff key, Kennedy key.

3. **Assembly drawings.**

    Drawing of assembled views for the part drawings of the following, using conventions and easy drawing proportions. (Any three ONLY)

    - Stuffing box

    - Pipe vice

    - Eccentric

    - Screw jack

4. Part drawings.

Preparation of part drawing representing limits, fits and tolerances and surface finish indications (Below mentioned part drawings ONLY).

- Petrol Engine connecting rod
- Single tool post
- Plummer block

II B. Tech. - I Semester
(16BT30332) MANUFACTURING TECHNOLOGY LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Course on Manufacturing Technology.

COURSE DESCRIPTION: Use of hand tools; Power tools for various manufacturing methods; Provides skill on sand testing; Pattern making; Mould preparation; Metal casting; Mechanical press working; Welding; Sheet metal works; Plastic moulding.

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

CO1. Demonstrate the practical usage and utilization of hand and power tools for engineering applications.

CO2. Analyze the part to be fabricated and manufacture using a combination of the manufacturing techniques.

CO3. Design and develop different components in the casting, welding, press work and plastic moulding.

CO4. Conduct investigation and provide best sequence of operations to manufacture a complex component.

CO5. Use modern tools and methods to solve engineering problems.

CO6. Follow safe practices during work practice in laboratory.

CO7. Function effectively as an individual and as a member of team to perform various process in Manufacturing of products.

CO8. Communicate the information of the components through drawings.

LIST OF EXPERIMENTS

Any **Twelve** Experiments are to be conducted and three from each section.

1. FOUNDRY

- Determination of grain fineness number of sand using sieve shaker.
- Determination of moisture content, clay content, permeability of moulding sand.
- Design and making a solid pattern using wood turn lathe.
- Preparation of green sand moulding arrangement and metal casing of solid pattern.
- Preparation of green sand moulding arrangement and metal casing of split pattern.
- Preparation of green sand moulding arrangement of hollow pipe/ T bent using core.

2. WELDING

- Exercises in welding lap joint and butt joint using arc welding process.
- Exercises in welding lap joint and butt joint using gas welding process.
- Exercises in welding lap joint by TIG and MIG welding process.
- Exercises in welding butt joint by spot welding process.
- Exercises in Metal cutting practice by gas cutting process.
- Exercises in brazing, braze welding and soldering.
- Simulation of welding.

3. **SHEET METAL WORK**

- Blanking and Piercing operation using fly press machine (one Exercise).
- Deep drawing and Extrusion operation using hydraulic press (one Exercise).
- Bending operation using bending machine (One Exercise).
- Simulation of sheet metal process.

4. **PLASTIC MOULDING**

- Making a component using injection moulding machine.
- Making a component using blow moulding machine.
- Making a component using compression moulding machine.
- Simulation of casting.

II B.Tech. – I Semester
(16BT30132) STRENGTH OF MATERIALS LAB
(Common to CE and ME)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Course on Strength of Materials.

COURSE DESCRIPTION: Tension test; Compression test; Bending test; Shear test; Torsion test; Hardness test; Maxwell reciprocal theorem.

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

CO1. Acquire the knowledge on conducting experiments for testing strength of materials such as steel, timber, metals, beams and springs.

CO2. Analyze test results on steel, timber, metals, beams and springs.

CO3. Recommend suitable materials for construction after interpreting test results.

CO4. Use appropriate method of testing construction materials.

CO5. Consider safety in construction material testing with societal perspective.

CO6. Follow ethics in reporting exact testing results.

CO7. Function effectively as an individual and as a team member in construction material testing.

CO8. Communicate effectively on construction material testing in written, oral and graphical forms.

ANY **TWELVE** EXPERIMENTS ARE TO BE CONDUCTED

1. Tension test on mild steel / HYSD bar

2. Compression test on wood

3. Compression test on coiled spring

4. Tension test on coiled spring

5. Bending test on carriage spring

6. Brinell and Rockwell hardness tests

7. Charpy and Izod impact tests

8. Shear test on mild steel

9. Bending test on simply supported beam

10. Bending test on cantilever beam

11. Bending test on fixed beam

12. Bending test on continuous beam

13. Bending test on overhanging beam

14. Verification of Maxwell's reciprocal theorem

15. Torsion test on mild steel

II B.Tech. - II semester

(16BT3HS01) **ENVIRONMENTAL STUDIES**

(Common to CE, ME, CSE, IT & CSSE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: Course on Engineering Chemistry

COURSE DESCRIPTION: Multidisciplinary nature of environment; Natural resources; Ecosystems; Biodiversity; Environment pollution and control; Social issues and environment; Human population and environment; Field studies.

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

CO1. Acquire knowledge on nature of environment, natural resources, ecosystems, biodiversity, environmental pollution and control, social issues and human population.

CO2. Analyze natural resources, ecosystems, biodiversity, environmental pollution and control, social issues and human population.

CO3. Develop strategies for environmental pollution control and natural resource management.

CO4. Solve environmental problems through proper analysis and interpretation of environmental data.

CO5. Choose appropriate techniques in environmental pollution control and natural resource management.

CO6. Understand the impact of social issues and population on environment.

CO7. Provide solutions to individuals, industries and government for environmental sustainable development.

CO8. Follow environmental protection laws for sustainable development.

CO9. Communicate effectively on environmental issues in the form reports.

DETAILED SYLLABUS:

UNIT - I: MULTIDISCIPLINARY NATURE OF ENVIRONMENT AND NATURAL RESOURCES   (11 Periods)

Multidisciplinary Nature of Environment: Multidisciplinary nature of environment, Segments of environment - Lithosphere, Hydrosphere, Atmosphere, Biosphere; Need for public awareness.

Natural Resources: Renewable and non-renewable resources and associated problems - (a) Forest resources: Use and over exploitation, Deforestation-causes, effects and remedies, Case studies, (b) Water resources: Use and over utilization of surface and groundwater, Conflicts over water, Benefits and problems of large dams, Case studies, (c) Mineral resources: Mining, Adverse effects, Case studies, (d) Food resources: World food problems, Changes caused by agriculture and overgrazing, Effects of modern agriculture, Water logging and salinity, Case studies, (e) Energy resources: Growing needs, Renewable energy resources – Solar, Wind, Hydropower, Hydrogen fuel; Non-renewable energy resources - Coal, Natural gas, Nuclear energy, Role of an individual in conservation of natural resource and equitable use of resources for sustainable lifestyles.

UNIT - II: ECOSYSTEMS AND BIODIVERSITY

(10 Periods)

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem - Producers, Consumers, Decomposers; Food chains, Food webs, Ecological pyramids – Types; Characteristic features, Structure and functions of forest ecosystem, Desert ecosystem, Aquatic ecosystem, Energy flow in the ecosystem, Ecological succession.

Biodiversity: Concept and value of biodiversity, Role of biodiversity in addressing new millennium challenges, Hot spots of biodiversity, Threats to biodiversity, Man-wild life conflicts, Endemic, Endangered and extinct species of India, Conservation of biodiversity – In-situ and ex-situ.

UNIT - III: ENVIRONMETAL POLLUTION AND CONTROL
(08 Periods)

Causes, Adverse effects and control measures of pollution - Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear pollution; Solid waste management

– Causes, Effects and control measures of urban and industrial wastes; Hazards and disaster management – Floods, Earthquakes, Tsunamis, Case studies.

UNIT - IV: SOCIAL ISSUES AND THE ENVIRONMENT
(08 periods)

Sustainable development, Urban problems related to energy, Environmental ethics –Issues, Solutions; Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and case studies, Wasteland reclamation, Consumerism and waste products, Concept of green technologies, Environment protection act, Air act, Water act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation, Public environmental awareness.

UNIT - V: HUMAN POPULATION AND THE ENVIRONMENT
(08 periods)

Population growth, Population characteristics and variation among nations, Population explosion, Family welfare programme, Environment and human health, Human rights, Value education, HIV/AIDS, Women and child welfare, Role of information technology in environment and human health, Case studies,

Field Work/Assignment/Seminar: Environmental assets – Pond/Forest/Grassland/Hill/ Mountain/Environment impact assessment procedures for local environmental issues.

Total periods: 45

TEXT BOOKS:

1. A. Kaushik and C. P. Kaushik, *Environmental Studies*, New Age International (P) Ltd Publications, 4th Edition, 2014.

2. Erach Barucha, *Environmental Studies*, Orient Blackswan, 2nd Edition, 2013.

REFERENCE BOOKS:

1. R. Rajagopalan, *Environmental Studies*, Oxford University Press, 2nd Edition, 2011.

2. Benny Joseph, *Environmental Studies*, Tata McGraw-Hill, 2nd Edition, 2009.

3. B. S. Chauhan, *Environmental Studies*, University Science Press, 2008.

4. M. Anji Reddy, *Text Book of Environmental Sciences and Technology*,BS Publications, 2007.

II B. Tech. – II Semester

(16BT40301) DESIGN OF MACHINE ELEMENTS-I

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Engineering Materials and Strength of Materials

COURSE DESCRIPTION: General considerations of design, design process; Manufacturing considerations, BIS codes of materials; Preferred numbers; Simple stresses, Combined stresses; theories of failure; Fatigue; Stress concentration; Goodman's line, Soderberg's line; design of welded joints; threaded joints; shafts; keys; sleeve or muff, and Flange couplings, Flexible couplings; spigot and socket cotter joint, Knuckle joint.

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

CO1. Demonstrate the knowledge on design of machine elements under different loading criteria.

CO2. Identify the design problems and analyze the stresses and strains induced in a machine element.

CO3. Design and develop the components for engineering problems.

CO4. Conduct investigations on complex problems in design of machine elements and provide suitable solutions.

CO5. Apply numerical techniques to determine the stress and strains induced in the components under mechanical loading.

CO6. Use the codes and standards of BIS, ASME and ISO in design procedures.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION TO DESIGN AND STRESSES IN MACHINE ELEMENTS   (09 Periods)

Introduction: Types of design, General considerations of design, Design process; Selection of engineering materials, Properties, Manufacturing considerations in the design. BIS codes of materials, Preferred numbers.

Stresses in Machine Members: Simple stresses, combined stresses, Torsional and bending stresses, Impact stresses, Stress-strain relation, Various theories of failures, Factor of safety.

UNIT - II: DESIGN FOR FLUCTUATING LOADS (07 periods)

Stress concentration, Notch sensitivity, Design for fluctuating stresses fatigue failure, Endurance limit, Estimation of Endurance strength - Goodman's line, Soderberg's line; Design of components for finite and infinite life.

UNIT - III: DESIGN OF THREADED AND WELDED JOINTS
(11 periods)

Threaded Joints: Basic Types of screw fastenings - cap screws, set screws; Bolts of uniform strength, locking devices, I.S.O. metric screw threads, bolts under tension, eccentrically loaded bolted joint in shear, eccentric load parallel and perpendicular to the axis of bolts, and plane containing the bolts.

Welded Joints: Introduction, welding process, types of welded joints, working stresses in welds, Strength of welds, Special cases of fillet welds, Eccentric loads on welded connections, Design procedure.

UNIT - IV: SHAFTS, KEYS AND COUPLINGS   (11 periods)

Shafts: Shaft design on the basis of strength, Torsional rigidity and Lateral rigidity, ASME code for shaft design.

Keys: Design of Keys - Sunk, Saddle, Tangent, Round, woodruff, Keyways and Splines.

Couplings: Design of couplings - Sleeve or Muff, Unprotected and Protected Flange couplings, Bushed–Pin type flange coupling.

UNIT - V: DESIGN OF COTTERS AND KNUCKLE JOINTS
(07 periods)

Sleeve and cotter joint, socket and spigot Joint, Gib and cotter joints, Knuckle joint.

Total Periods: 45

TEXT BOOKS:

1. V. B. Bhandari, *Design of Machine Elements*, Tata McGraw-Hill, 3rd Edition, 2011.

2. Dr. N. C. Pandya and Dr. C. S. Shah, *Machine Design*, Charotar Publishing House Pvt. Limited, 20th Edition, 2015.

REFERENCE BOOKS:

1. Joseph E. Shigley, *Mechanical Engineering Design*, TMH, 9th Reprint Edition, 2011.

2. Kannaiah, *Machine Design*, Scitech, 3rd Edition, 2010.

II B. Tech. - II Semester
(16BT40302) DYNAMICS OF MACHINERY

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Kinematics of Machinery.

COURSE DESCRIPTION: Clutches, brakes and dynamometers; Gyroscopic couple, Turning moment diagrams, flywheel design; Analysis and balancing of shaking forces in machines; Governors; Vibrations, single degree, Multi degrees of freedom vibrations, spring mass systems; transmissibility of forces, Dunkerley's method, Rayleigh's method; Whirling of shafts; isolation of systems.

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

CO1.   Demonstrate the knowledge on dynamical analysis of machine elements for design process.   .

CO2.   Analyze dynamic systems through systematic approach by identifying suitable sub systems.

CO3.   Design dynamic systems involving imbalance, flywheel and gyroscopic effects.

CO4.   Conduct investigations on the unbalanced forces in a multi-cylinder reciprocating engine.

CO5.   Apply the various methods to reduce the vibration effects in the operation of mechanical components.

DETAILED SYLLABUS:

UNIT - I: CLUTCHES, BRAKES AND DYNAMOMETERS:
(09 Periods)

Clutches: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

Brakes and Dynamometers: Simple block brakes-Single block, Pivoted block, Double block; simple Band brake, Differential Band Brake, Band and Block Brake, internal expanding brake. Dynamometers—absorption and transmission types; General description and methods of operation.

UNIT - II: GYROSCOPE AND FLYWHEEL   (09 Periods)

Gyroscope: Gyroscopic couple, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aeroplanes and ships.

Fly wheel: Turning moment diagrams for steam engine, IC Engine and multi cylinder engine, Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed – Fly wheels and their design, Fly wheels for Punching machines.

UNIT - III: GOVERNORS   (09 Periods)

Watt, Porter and Proell governors; Spring loaded governors – Hartnell and Hartung governors with auxiliary springs; Sensitiveness, isochronism and hunting; Effort and power of a governor.

UNIT - IV: BALANCING OF MASSES   (09 Periods)

Balancing of Rotating Masses: Single and multiple – Single and different planes.

Balancing of Reciprocating Masses: Primary and Secondary balancing of reciprocating masses, Analytical and graphical methods, Unbalanced forces and couples – V-engine, multi cylinder inline and radial engines for primary and secondary balancing.

UNIT - V: VIBRATIONS   (09 Periods)

Classification, Free and forced vibration of single degree of freedom system, Role of damping, whirling of shafts and critical speeds, Simple problems on free, forced and damped vibrations, Vibration Isolation & Transmissibility, Transverse vibrations of beams with concentrated and distributed loads, Dunkerly's method, Torsional vibrations - two and three rotor systems.

Total Periods: 45

TEXT BOOKS:

1.   S.S.Rattan, *Theory of Machines and Mechanisms*, Tata McGraw Hill Publishers, 4th Edition, 2016.

2.   R.S. Khurmi, *Theory of Machines*, S.Chand Publications, 14th Revised Edition, 2012.

REFERENCE BOOKS:

1. Joseph Edward Shigley and John Joseph Uicker, Jr. *Theory of Machines and Mechanisms*, 2nd Edition, MGH, New York.

2. Ballaney P L, *Theory of Machines and Mechanisms*, Khanna Publishers, New Delhi,2005

3. Bevan T, *Theory of Machines*, CBS Publishers and Distributors, NewDelhi, 3rd Edition, 2002.

4. J.S. Rao and R.V. Dukkipati, *Mechanism and Machine Theory*, New age International, 2nd Edition, 2007.

II B. Tech. – II Semester

(16BT40303) FLUID MECHANICS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Engineering Mechanics.

COURSE DESCRIPTION: Properties of Fluids; Pressure Measurements; Types of flow; One-dimensional steady flow energy & momentum Equations; Flow measurements; Impact of jets on stationary & moving plate; Hydraulic turbines and its performance; Pumps; Components and phenomena of hydroelectric power stations.

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

CO1.   Demonstrate the basic knowledge of hydraulics in finding fluid properties, performance parameters of hydraulic turbines and pumps.

CO2.   Identify, formulate and analyze hydraulic machines to study the characteristics of various flow of fluids.

CO3.   Develop feasible design solutions to the construction of efficient hydraulic turbines and pumps.

CO4.   Conduct investigations and address the complex problems in fluid Mechanics.

CO5.   Apply mathematical models for hydraulic systems to study their characteristics.

CO6.   Design various Hydraulic systems as per requirements of society based on standard engineering norms and practices.

DETAILED SYLLABUS:

UNIT - I: PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENT   (09 Periods)

Properties of Fluids: Dimensions and units, Physical properties of fluids - Mass density, Specific weight, Specific volume, Specific gravity, Viscosity, Surface tension, Capillarity, Vapor

pressure and its influence on fluid motion, Bulk modulus, compressibility; Types of fluids - Ideal and Real fluids, Newtonian and Non Newtonian fluids.

Pressure Measurement: Absolute Pressure, Gauge Pressure, Atmospheric Pressure, Vacuum Pressure, Manometers - Piezometer, U-tube, Single column manometer and Differential manometers.

UNIT - II: FLUID KINEMATICS AND DYNAMICS (09 Periods)

Kinematics: Classification of fluid flows – Steady, Unsteady, Uniform, Non-uniform, Laminar, Turbulent, Rotational flows, Irrotational flows, Compressible flows, incompressible flows; Types of flow lines - Path line, Stream line, Streak line, stream tube; Equation of continuity for one dimensional flow.

Dynamics: Surface and body forces, Different types of heads, Euler's and Bernoulli's equations for flow along a stream line, Momentum equation and its application on force on pipe bend.

Measurement of Flow: Pitot tube, Venturimeter, and Orifice meter.

UNIT - III: FLOW THROUGH PIPES AND IMPACT OF JETS (09 Periods)

Flow Through Pipes: Reynold's experiment, Darcy Weisbach equation, Chezy's equation, Minor losses in pipes, Equivalent pipe, Pipes in series and pipes in parallel, Total energy line and Hydraulic Gradient Line.

Impact of Jets: Hydrodynamic force of jets on stationary, Moving flat, Inclined, Curved vanes, Jet striking centrally and at tip, Velocity diagrams, Work done and Efficiency.

UNIT - IV: HYDRAULIC TURBINES AND THEIR PERFORMANCE (09 Periods)

Hydraulic turbines: Classification of turbines - Impulse, Reaction turbines; Pelton wheel – Construction, Working principle, Work done, Efficiencies; Francis turbine – Construction,

Working principle, Work done, Efficiencies; Kaplan turbine - Construction, Working principle, Work done, Efficiencies; Draft tube theory - functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Specific speed, Unit quantities, Characteristic curves, Governing of turbines, Selection of type of turbine, Water hammer, Cavitation, Surge Tank.

UNIT - V: HYDRAULIC PUMPS   (09 Periods)

Centrifugal pumps: Classification, Single stage Centrifugal pump - Working Principle, Work done, heads, Losses and Efficiencies; Multi stage Centrifugal pump, Pumps in series, Pumps in parallel, Characteristic curves, Specific speed, Net positive suction head.

Reciprocating pumps: Construction and Working Principle of single acting, Double acting reciprocating pumps, Discharge, Slip, Air vessels, Indicator diagrams.

Total Periods: 45

TEXT BOOKS:

1. R.K. Rajput, *Fluid Mechanics and Hydraulic Machines*, S. Chand, 4th Edition, 2008.

2. Modi and Seth, *Fluid Mechanics and Hydraulic Machinery*, Standard book house, 17th Edition, 2011.

REFERENCE BOOKS:

1. R.K. Bansal, *Fluid Mechanics and Hydraulic Machinery*, Laxmi publications, 9th Edition 2005.

2. D.S. Kumar, *Fluid Mechanics and Fluid Power Engineering*, Kotaria & Sons, 7th Edition 2009.

II B. Tech. — II Semester

(16BT40304) MACHINE TOOLS AND MODERN MACHINING PROCESSES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Manufacturing Technology.

COURSE DESCRIPTION: Theory of Metal Cutting; Geometry of Cutting Tools; Merchants Force Diagram; Lathe Machine-Principle of Operation; Tools; Multi spindle lathes; shaping; slotting and planning machines; drilling; boring; jigboring; milling machine Specifications; grinding; lapping; honing.

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

CO1. Demonstrate the concepts of machining methods using various machine tools.

CO2. Identify various cutting tools used for different operations and analyze its behavior.

CO3. Design the cutting tools for appropriate machining operation.

CO4. Conduct investigation on complex problems during metal cutting operation.

CO5. Apply Modern Machining processes to produce intricate shapes.

CO6. Use the ORS and ASA system of standards in single point cutting tools for engineering practice.

DETAILED SYLLABUS:

UNIT – I: THEORY OF METAL CUTTING   (09 Periods)

Introduction, Basic elements of machining, Nomenclature and Geometry of single point cutting tool, ORS and ASA systems, Cutting speed, Feed, Depth of cut, Chip formation and Types of chips, Chip breakers, Orthogonal and Oblique cutting, Mechanics of Orthogonal cutting - Cutting forces, Merchant's circle diagram, Tool life, Tool failure, Thermal aspects-Coolants, Tool materials.

UNIT – II : LATHE MACHINES   (09 Periods)

Engine Lathe: Principle of operation, Specifications of lathe, Types of lathes, Work and tool holding devices, Operations on Lathe, Methods of Taper turning, Special attachments.

Turret and capstan lathes: Construction and working, Tool layout.

Automatic lathes: Classification–single spindle and multi-spindle automatic lathes.

UNIT – III: SPECIAL MACHINES-I   (09 Periods)

Shaping; Slotting and planning machines: Principle of operation, Classification, Principal parts, specifications, Operations performed, Machining time calculations.

Drilling and Boring Machines: Principle of operation, Specifications, Types of Drilling machines, Different Operations, Tool holding devices, Twist drill, Boring machines –Jig boring machines.

UNIT – IV: SPECIAL MACHINES-II   (10 Periods)

Grinding machine: Principle of operation, Types - cylindrical grinding machine, Surface grinding machine, Tool and cutter grinding machine, special types of grinding machines; Different types of abrasives, bonds, specification and selection of grinding wheel, Balancing, Loading and Glazing, Truing, Dressing of grinding wheel, Comparison of grinding, lapping and honing.

Milling machine: Principle of operation, Classification, Specifications, Up milling and Down milling, Types of Horizontal milling machines, Vertical milling machines, Milling operations, Types of milling cutters, Tool and work holding devices, Methods of indexing, Accessories .

UNIT – V: MODERN MACHINING PROCESSES (08 Periods)

Introduction, Classification of modern machining processes-Ultrasonic machining (USM), Abrasive jet machining(AJM), Electro chemical machining(ECM), Electro discharge machining(EDM), Electron beam machining(EBM), Laser beam machining(LBM), Plasma arc machining(PAM).

Total Periods: 45

TEXT BOOKS:

1. Hazra Choudary S.K. and Hazra Choudary A.K., *Elements of Workshop Technology*, Vol II, Media Promoters, 12th Edition, 2007.

2. B.S.Raghuwanshi, *A course in Workshop Technology*, Vol II, Dhanpat Rai and Co(P) Ltd, 9th Edition, 1998.

REFERENCE BOOKS:

1. H.M.T. (Hindustan Machine Tools), *Production Technology*, Tata Mcgrawhill Education, 2013.

2. Vijay K Jain, *Advanced Machining Processes*, Allied publishers, 2012.

3. R.K. Jain, *Production Technology*, Khanna Publishers, 17th Edition, 2012.

II B. Tech. – II Semester

(16BT40305)THERMAL ENGINEERING-I

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Thermodynamics.

COURSE DESCRIPTION: Comparison of air-standard and actual cycles; Components and working of 2-stroke and 4-stroke engines; Combustion phenomena in spark ignition and compression ignition engines; Performance parameters of an internal combustion engine; Estimating heat losses in an engine; Components and working of reciprocating and rotary compressors.

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

CO1. Demonstrate the basic knowledge of an engine and air compressor in developing the analytical models.

CO2. Analyze the combustion and performance parameters of SI engines and CI engines and analyze the performance of air compressors.

CO3. Provide solutions in the design of IC engine.

CO4. Conduct investigation on IC engines for performance improvement and emission reduction.

CO5. Apply new combustion techniques to analyze the combustion in IC Engines.

DETAILED SYLLABUS:

UNIT - I: I.C. ENGINES   **(09 Periods)**

Classification of I.C. Engines, engine components, Working of two stroke and four stroke engines, Comparison of two stroke and four stroke engines, comparison of SI and CI engines, Valve and port timing diagrams, application of I.C engines, Fuel air cycles -Composition of cylinder gases, variable specific heats, dissociation, number of moles Actual cycle - heat loss, time loss, exhaust blow down factors and loss due to rubbing friction.

UNIT - II: COMBUSTION IN S.I. AND C.I. ENGINES
(10 Periods)

Combustion in S.I. Engines: Stages of combustion in SI engines, Flame front propagation, Factors influencing the flame speed, Abnormal combustion, Phenomenon of knock in S.I engines, Combustion chambers for SI Engines, Fuel Requirements and Fuel Rating.

Combustion in C.I. Engines: Stages of combustion in C.I engines, Factor affecting delay period; Phenomenon of knock in C.I engine, comparison of knock in S.I and C.I engines, Combustion chambers for C.I engines, Fuel Requirements and Fuel Rating.

UNIT - III: PERFORMANCE OF I.C. ENGINES   (10 Periods)

Performance parameters: Brake power, Indicated power, Friction power, Mean effective pressure, Engine efficiencies, Performance calculations, Heat balance.

Measurement of Performance parameters: Brake power - Rope brake, hydraulic, Eddy current and swinging field DC dynamometers; Measurement of Friction power - Willian's line method, Morse test, motoring test and retardation test; Air and fuel measurement.

UNIT - IV: FUELS AND COMBUSTION   (08 Periods)

Introduction, Classification of fuels - Solid fuels, Liquid fuels, Gaseous fuels; Combustion equation, Theoretical air and excess air; Stoichiometric air fuel ratio, Air fuel ratio from analysis of product, Analysis of exhaust gas and flue gas, Internal energy and enthalpy formation, Determination of calorific values of fuels, Adiabatic flame temperature, Chemical equilibrium.

UNIT - V: AIR COMPRESSORS   (08 Periods)

Air Compressors - Reciprocating Compressors, Effect of Clearance volume in Compressors, Volumetric Efficiency, Single Stage and Multi Stage Compressors, Effect of Inter cooling and Pressure Drop in Multi - Stage Compressors; Working principles of Roots blower, Vane type Blower, Centrifugal Compressor, Axial Flow Compressors.

Total Periods: 45

SVEC16 - B.TECH - MECHANICAL ENGINEERING

TEXT BOOKS:

1. V. Ganesan, *I.C. Engines*, TMH, 3rd Edition, 2008.

2. R.K.Rajput, *Thermal Engineering*, Laxmi publications, 8th Edition, 2010

REFERENCE BOOKS:

1. M.L Mathur & R.P.Sharma, *Internal combustion engines*, Dhanpat Rai & Sons, 8th Edition, 2014.

2. Mahesh M Rathore, *Thermal Engineering*, Tata Mcgrawhill Education, 2010.

II B. Tech. - II Semester
(16BT40331) **FLUID MECHANICS LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Course on Fluid Mechanics.

COURSE DESCRIPTION: The study and calibration of gauges, Orifice meter, Venturi meter. Determination of Darcy's coefficient; Performance test on Hydraulic Machines like Centrifugal Pump, Reciprocating pump, Francis Turbine, Kaplan Turbine, and Pelton wheel turbine; Study of Bernoulli's theorem verification, Head losses in pipes and impact of jet on vanes.

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

CO1. Demonstrate the knowledge on various flow measuring instruments.

CO2. Analyze the losses and discharge in pipes.

CO3. Design systems for evaluate the performance of hydraulic machineries

CO4. Conduct experiments, analyze the data and interpret results.

CO5. Provide solutions to various hydraulic systems by using computational tools.

CO6. Work with others to accomplish the common goals.

CO7. Communicate effectively and express the results with clarity.

LIST OF EXPERIMENTS

ANY **TWELVE** EXPERIMENTS ARE TO BE CONDUCTED.

1. Calibration of Venturimeter

2. Calibration of Orifice meter

3. Determination of coefficient of discharge for a small Orifice by a constant head method

4. Calibration of Rectangular notch

5. Determination of loss of head due to sudden contraction

6.   Determination of friction factor for pipes

7.   Verification of Bernoulli's equation

8.   Impact of jet on vanes

9.   Study of hydraulic jump

10. Performance test on Pelton wheel turbine

11. Performance test on Francis turbine

12. Performance test on Kaplan turbine

13. Performance test on Single stage centrifugal pump

14. Performance test on Multi stage centrifugal pump

15. Performance test on Reciprocating pump

II B. Tech. - II Semester
(16BT40332) MACHINE TOOLS LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Course on Machine Tools and Modern Machining Processes.

COURSE DESCRIPTION: Demonstration on lathe; drilling; milling; slotting machine; shaper; grinding machine; milling machine; provides skill on making products using machines tools.

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

CO1. Demonstrate practical knowledge on utilization of machine tools for engineering and domestic applications

CO2. Analyze and perform step turning, taper turning, thread cutting, drilling and tapping operations on lathe, operations on shaper, planer and milling machines.

CO3. Design and model different components using machine tools .

CO4. Conduct experiments, investigate the products quality and interpret the results.

CO5. Select and apply relevant cutting tools for machining operations.

CO6. Relate knowledge based on standard engineering norms and practices to make products to cater the needs of the society.

CO7. Formulate the team to attain multidisciplinary settings.

CO8. Communicate effectively and present technical information in oral and written form

LIST OF EXPERIMENTS

ANY **TWELVE** EXPERIMENTS ARE TO BE CONDUCTED AND SIX FROM EACH SECTION.

1. TRADE: LATHE

1. Study of a centre lathe and turret lathe
2. Straight turning, Facing and chamfering operation
3. Step turning, chamfering and knurling operation
4. Taper turning, grooving operation
5. Thread cutting (RH -V-Thread) and grooving operation
6. Thread cutting (LH - V-Thread) and grooving operation
7. Drilling and boring operation

2. TRADE: SPECIAL MACHINE

1. Study of special machines
2. Drilling, tapping and reaming using radial drilling machine
3. V - Block shaping using shaping machine
4. 4 Internal splines cutting using slotting machine
5. Single point cutting tool Grinding using tool and cutter grinder
6. Profile cutting using vertical milling machine
7. Spur gear cutting using horizontal milling machine
8. Surface grinding operation using surface grinder
9. Cylindrical grinding machine using cylindrical grinder
10. Gear Hobbing using gear Hobbing machine

II B. Tech. - II Semester

(16BT4HS31) SOFT SKILLS LAB

(Common to CE, ME, CSE, IT & CSSE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Courses on English Language Laboratory in I B.Tech or English Laboratory at Diploma Level.

COURSE DESCRIPTION: This course covers Body Language; Assertiveness; Goal Setting; Creative Thinking; Interpersonal Skills; Team Work; Conflict Management; Etiquette; Report Writing; Group Discussions; Interviewing Skills.

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

CO1. Acquire knowledge in
- Goal Setting
- Creative Thinking
- Leadership Skills and
- Team Work

CO2. Analyse the situations and develop skills for
- Body Language
- Personality Development and
- Stress Management

CO3. Apply the techniques of soft skills in a problem situation enhanced through multimedia software.

CO4. Function effectively as an individual and as a member in diverse teams.

CO5. Communicate effectively in public speaking in formal and informal forums.

LIST OF EXERCISES

1. Body Language
2. Assertiveness
3. Goal Setting
4. Creative Thinking
5. Interpersonal Skills

6. Team Work
7. Conflict Management
8. Etiquette
9. Report Writing
10. Resume Writing
11. Group Discussions
12. Interviewing Skills

REFERENCE BOOKS:

1. R. C. Sharma & Krishna Mohan, *Business Correspondence and Report Writing*, Tata McGraw-Hill Publishing Company Limited, Third Edition, New Delhi, 2012.

2. Gopalswamy Ramesh and Mahadevan Ramesh, *The Ace of Soft Skills*, Pearson, Noida, 2010.

3. Jeff Butterfeild, *Soft Skills for Everyone*, Cengage learning, Delhi, 2011.

4. Barun K. Mitra, *Personality Development and Soft Skills*, Oxford University Press, Noida, 2012.

SUGGESTED SOFTWARE

1. ETNL Language Lab Software Version 4.0
2. GEMS – Globarena E- Mentoring System
3. Speech Solutions
4. English Pronunciation Dictionary by Daniel Jones
5. Learning to Speak English 8.1, The Learning Company – 4 CDs
6. Mastering English: Grammar, Punctuation and Composition
7. English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge
8. Dorling Kindersley Series of Grammar, Punctuation, Composition etc.
9. Language in Use 1, 2 & 3
10. Cambridge Advanced Learner's Dictionary - 3rd Edition
11. Centronix – Phonetics
12. Let's Talk English, Regional Institute of English South India
13. Ultimate English Tutor

III B. Tech. - I semester

(16BT50301)DESIGN OF MACHINE ELEMENTS -II

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Design of Machine Elements-I.

COURSE DESCRIPTION: Study, analysis and design of machine components such as Journal bearings - anti friction bearings; spur gears, helical gears; Design of helical and leaf springs; internal combustion engine parts such as piston, crank and connecting rod; Design of belt drives; Safety and reliability consideration in machine design; detailed design to define the shape, size and material.

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

CO1. Demonstrate knowledge in design of machine elements to withstand the loads and deformations for a given application, while considering additional specifications.

CO2. Analyze the forces acting and stresses in the machine components for designed mechanical properties.

CO3. Design the bearing, gears, mechanical springs and IC engine parts.

CO4. Investigate the reasons for failure of machine elements and provide solutions/improvisation to improve trial designs.

CO5. Use empirical relationships for solving complex problems in the design of IC engine parts.

CO6. Apply the contextual knowledge to provide safe designs as per the standards and needs for real time applications.

DETAILED SYLLABUS:

UNIT – I: JOURNAL BEARINGS   (09 Periods)

Lubricants, Types of lubrication, Hydrodynamic and hydrostatic lubrication, Bearing modulus, Friction circle, Bearing characteristic number, McKee's equation, Sommerfeld number, Types of journal bearings, Full and partial journal bearings, Clearance ratio, Bearing materials, Journal bearing design, Bearing life, Failure of bearings.

UNIT – II: ANTI FRICTION BEARINGS   (09 Periods)

Ball and Roller Bearings, Nominal life, Average life, Static load, Dynamic load, Equivalent radial load, Design and Selection of ball and roller bearings.

UNIT – III: GEARS   (09 Periods)

Classification of Gears, Gear materials, Force analysis of spur and helical gear, Beam Strength of Gear Teeth – Lewis Equation, Wear strength of Spur and Helical gear tooth, Causes of Gear Tooth Failure, Design Procedure for Spur and Helical Gears.

UNIT – IV: MECHANICAL SPRINGS   (09 Periods)

Introduction, Classification of springs, Stress and deflections of helical springs, Design of helical springs, Springs for fatigue loading, Energy storage capacity in helical springs, Concentric springs, Design of leaf springs.

UNIT – V: I.C. ENGINE PARTS AND POWER TRANSMISSIONS SYSTEMS   (09 Periods)

Design of I.C. Engine Parts: Piston, Cylinder, and Connecting Rod.

Design of Power Transmissions Systems: Design of Flat belt drives, V-belt drives & rope drives.

Total Periods: 45

TEXT BOOKS:

1. V. B. Bhandari, *Design of Machine Elements*, Tata McGraw-Hill, 3rd Edition, 2010.

2. T. Krishna Rao, *Design of Machine Elements Vol-II*, I K International, 1st Edition, 2008.

REFERENCE BOOKS:

1. Joseph E. Shigely, *Mechanical Engineering Design*, TMH Publishers, 9th Edition, 2011.

2. R.S. Khurmi & J.K. Gupta, *Machine Design*, Eurasia Publishing House (pvt.) Ltd. 2005.

Data Book: Design data hand book for Mechanical Engineers in SI and Metric units by Balaveera Reddy and Mahadevan.

NOTE: Specified design data books are permitted in the examinations.

III B. Tech. – I Semester

(16BT50302)INDUSTRIAL ENGINEERING AND MANAGEMENT

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Concepts and functions of management and organization; selection and analysis of plant location and plant layout; method study and work measurement; inventory, stores and purchase management functions; techniques of statistical process control; Engineering ethics; industrial safety.

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

CO1. Demonstrate the knowledge of Industrial Engineering and Management concepts to the Solution of complex engineering problems in an industrial scenario.

CO2. Analyze Industrial problems, identify probable causes and suggest suitable solutions to increase the productivity by reducing the wastages using Principles of Management, and Industrial engineering concepts.

CO3. Design and develop integrated systems that include people, materials, information and equipment that meet the specified needs with appropriate considerations.

CO4. Investigate and employ systematic approach to simplify a complex problem in to a Manageable Sub problem for quicker solution.

CO5. Apply appropriate techniques such as method study, control charts, skills, resources, and modern engineering tools like TQM necessary for engineering practices with an understanding of the limitations.

CO6. Consider safety issues in the providing engineering solutions in industrial scenario.

DETAILED SYLLABUS:

UNIT – I: PRINCIPLES OF MANAGEMENT (09 Periods)

Concepts of Management and Organization - Evolution of management thought, Taylor's scientific Management, Fayol's principles of Management; Managerial Skills, levels of Management, Systems approach to management, Functions of management, Theory of Motivation - McGregor Theory X and Y; Hierarchy of Needs - Maslow's Theory of Human Needs; Corporate planning process, SWOT Analysis, Corporate Social Responsibility.

UNIT – II: FACILITIES PLANNING AND MAINTENANCE

(10 Periods)

Types of production, Plant location – definition, factors affecting the plant location, comparison of rural and urban sites; Plant layout – definition, Objectives, Types of plant layout; Plant Maintenance - objectives, functions, Types and Advantages of Plant Maintenance; Types of maintenance, Concepts of Reliability – Definition, MTBF, Series, Parallel and Series-Parallel device configurations; Redundancy.

UNIT – III: WORK STUDY (07 Periods)

Productivity, Objectives of Work Study, Method study - Definition, Objectives, Steps involved; Work measurement – definition, Time study, Steps involved, Equipment, Different methods of performance rating, allowances; Work sampling – definition, Steps involved, Standard time calculations.

UNIT – IV: MATERIALS MANAGEMENT (10 Periods)

Objectives of Materials Management, Stores management and stores records, Purchase management, Value Analysis, Inventory – Functions, Types, Associated costs, Inventory classification techniques, Factors involved in inventory problem analysis, Inventory costs and deterministic inventory control models - single item inventory control models without shortages, with shortages, with quantity discounts.

UNIT – V: QUALITY CONTROL & INDUSTRIAL SAFETY

(09 Periods)

Quality control: Introduction and Definition of Quality, quality control, process control, Control charts for variables and attributes, Process capability, Acceptance sampling- OC Curve, Sampling Plan; Total Quality Management (TQM)-Total Quality Control, Concepts of TQM, Elements of TQM, Benefits of TQM, Benchmarking.

Industrial safety: General Safety Rules, Duties of Plant Safety Inspector, Investigation and analysis of Accidents, Indian Factories Act, Workmen Compensation Act, Industrial Disputes Act.

Total Periods: 45

TEXT BOOKS:

1. O.P. Khanna, *Industrial Engineering and Management*, Dhanpat Rai Publications, 17th Edition, 2014.

2. Martand Telsang, *Industrial Engineering and Production Management*, S.Chand, 2nd Edition, 2006.

REFERENCE BOOKS:

1. Stoner, Freeman, Gilbert, *Management*, Pearson Education, 6th Edition, 2003.

2. M. Mahajan, *Industrial Engineering and Production Management*, Dhanpat Rai Publications, 2nd Edition, 2005.

3. R. Panneerselvam, *Production and Operations Management*, PHI, 3rd Edition, 2012.

4. Ralph M. Barnes, *Motion and Time Study:Design and Measurement of Work*, John Wiley & Sons, 7th Edition, 1980.

III B. Tech. — I Semester
(16BT50303) METROLOGY AND MEASUREMENTS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Engineering Physics, Computer Aided Machine Drawing Lab and Machine Tools and Modern Machining Processes.

COURSE DESCRIPTION: Limits, Fits and Tolerances; Limit Gauges and Gauge Design; Comparators; Linear Measurement; Measurement of Angles and Tapers; Flatness Measurement, Surface Roughness Measurement; Measurement of Displacement; Measurement of Speed, Stress & Strain Measurements; Measurement of Temperature; Measurement of Pressure.

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

CO1. Demonstrate the knowledge on various instrument/ measurement methods for a given application.

CO2. Identify, formulate and analyze complex problems related to metrology and measurements.

CO3. Design and Develop the solutions for real time problems related to measurements and its applications.

CO4. Conduct investigation on advanced measuring techniques for the Industrial applications.

CO5. Use modern tools and methods to solve engineering problems.

DETAILED SYLLABUS:

UNIT- I: INTRODUCTION, LINEAR MEASUREMENT, LIMITS, FITS AND TOLERANCES   (10 Periods)

Introduction: Metrology, Measurement, units, Range, accuracy, precision, typesoferrors, readability, calibration and reproducibility.

Linear Measurement: Length standard, Line and End & Wavelength standards, Slip Gauges, Calibration of the slip gauges, Numericals related to slip gauges.

Limits, Fits and Tolerances: Introduction, Definitions, fits and their types, Unilateral and Bilateral Tolerance System, Hole and Shaft basis systems, Interchangeability and Selective Assembly, Fundamental Tolerance, Numericals related to limits and fits.

UNIT-II: LIMIT GAUGES, COMPARATORS, ANGULAR AND TAPER MEASUREMENT (10 Periods)

Limit Gauges: Gauges- Plug, Ring, Snap, Gap, Taper gauges, Taylor's principle.

Comparators: Introduction to comparator, Characteristics, Classification of comparators, Mechanical comparators- Sigma Comparators, Optical Comparators, LVDT, Pneumatic Comparators.

Measurement of Angles and Tapers: Different methods-Bevel protractor, Angle gauges Spirit levels, Sine bar, Sine plate, Rollers and Spheres used to determine the tapers.

UNIT-III: FLATNESS, SURFACE ROUGHNESS MEASUREMENT (09 Periods)

Flatness Measurement: Measurement of flatness of surfaces, Straight edges, Surface plates optical flat and Auto collimators, Interferometer and their uses.

Surface Roughness Measurement: Differences between surface roughness and Surface waviness, Methods of measurement of surface finish- Profilograph, Talysurf; BIS symbols for indication of surface finish.

UNIT-IV: SCREW THREAD AND GEAR MEASUREMENT (09 periods)

Screw Thread Measurement: Elements of measurement, Errors in screw threads, Measurement of effective diameter, Angle of thread and Thread pitch by 2-wire and 3-wire methods, Profile thread gauges.

Gear Measurement: Gear measuring instruments, Gear tooth profile measurement, Measurement of diameter, Pitch, Finding pressure angle and Tooth thickness.

UNIT-V: STRESS, STRAIN, TEMPERATURE AND PRESSURE MEASUREMENT (07 Periods)

Measurement of Stress and Strain: Various types- 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 Temperature and Pressure: Standards and calibration, Thermal expansion methods, Thermo electric sensors (thermocouples), Electrical Resistance sensors, Junction semiconductor sensors, Digital thermometers, Radiation methods, Pressure measurements - Standards and Calibration, Basic methods of pressure measurement, Dead weight gauge.

Total Periods: 45

TEXT BOOKS:

1. R.K. Jain, *Engineering Metrology*, Khanna Publishers, 20th edition, 2013.

2. N.V Raghavendra, L.Krishnamurthy, *Engineering Metrology and Measurements*, Oxford University Publisher, 2013.

3. M. Mahajan, *Engineering Metrology*, Dhanpat Rai and Co., 2nd edition, 2013.

REFERENCE BOOKS:

1. Thomas G. Beckwith, Roy D. Maragoni, John H. Lienhard V, *Mechanical Measurements*, Pearson Education International Publishers, 6th edition, 2013 .

2. Anand K Bewoor, Vinay A Kulkarni, *Metrology & Measurement*, Mc Graw Hill, 1st Edition, 2013.

3. B.C.Nakra & K.K. Choudhary, *Instrumentation, Measurement & Analysis*, Tata Mcgraw Hill, 6th edition, 2011.

III B. Tech. – I Semester
(16BT50304) **REFRIGERATION AND AIR – CONDITIONING**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Thermodynamics and Fluid Mechanics.

COURSE DESCRIPTION: Refrigeration cycles; Application of thermodynamics; heat transfer to the refrigeration cycles; Analysis and design of various refrigeration systems; Study of components of refrigeration system; refrigerants selection; Psychrometry; Heat gain and Heat loss calculations. Air conditioning equipment; load calculations.

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

CO1. Demonstrate the knowledge on the concepts and applications of RAC systems.

CO2. Identify the RAC problems and analyze refrigeration requirements to arrive at an outline configuration of the refrigeration system.

CO3. Design RAC systems for physical systems and predict their performance.

CO4. Conduct investigation on complex problems of RAC systems.

CO5. Apply Psychrometric charts and refrigeration charts in evaluate the performance of RAC systems.

CO6. Consider health and safety issues in the design of RAC systems for societal needs.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION TO REFRIGERATION SYSTEM
(09 Periods)

Introduction, Unit of Refrigeration, C.O.P., Refrigerator, Heat pump, Classification, open and dense air refrigeration cycle, Carnot refrigerator, Bell-Coleman cycle; Air Refrigeration - simple air cooling system, simple air evaporative cooling system and bootstrap air cooling system.

UNIT - II: VAPOUR COMPRESSION REFRIGERATION (VCR) SYSTEM (09 Periods)

Basic cycle, Working principle and essential components of the plant, COP, Representation of cycle on T-S and P-H charts, Cycle analysis, Actual cycle, effect of super heating, sub cooling on system performance.

Refrigerants: Classification, Desirable properties, Nomenclature, selection of refrigerants, and newer refrigerants.

UNIT - III: VAPOUR ABSORPTION REFRIGERATION SYSTEM (09 Periods)

Classification, Working principle of NH_3 – water system, Li Br – water (Two shells & four shells) system, Calculation of maximum COP, Operation of three fluid absorption system.

Steam jet refrigeration system: Working principle, basic components, Estimation of motive steam required.

Non conventional refrigeration system: Principle and operation of Thermo-electric refrigerator and Vortex tube.

UNIT - IV: AIR CONDITIONING SYSTEMS (09 Periods)

Psychrometry, psychrometric chart, psychrometric processes, classification of air-conditioning systems, summer, winter and year round air conditioning systems; Room Sensible Heat Factor(RSHF), Grand Sensible Heat Factor (GSHF), Effective Room Sensible Heat Factor (ERSHF); cooling load calculations, sensible heat load, latent heat load.

UNIT - V: COMFORT AIR CONDITION AND EQUIPMENT (09 Periods)

Comfort Conditions: Requirements of human comfort, concept of effective temperature, Comfort chart.

Humidifiers: Humidification by atomizing the water and Air washing, Dehumidifiers - Spray type dehumidifier; Air-filters, Fans, Blowers, Ducts.

Heat pump: Introduction, different heat pump circuits, air to air, water to air.

Total Periods: 45

TEXT BOOKS:

1. Domkundwar Arora Domkundwar, *A Course in Refrigeration and Air conditioning*, Dhanpat Rai publication, 8th Edition, 2011.

2. C.P Arora, *Refrigeration and Air Conditioning*, TMH, 8th Edition, 2011.

REFERENCE BOOKS:

1. P.L.Ballaney, *Refrigeration and Air Conditioning*, Khanna Publications, 15th Edition, 2003.

2. Manohar Prasad, *Refrigeration and Air Conditioning*, New Age International, 3rd Edition, 2015.

3. R. S. Khurmi, J.K.Gupta, *A Text book of Refrigeration & Air Conditioning*, S. Chand, 5th Edition, 2014.

III B. Tech. — I Semester
(16BT50305) THERMAL ENGINEERING-II

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Thermal Engineering-I.

COURSE DESCRIPTION: Concept of Rankine Cycle in Steam Power Plant; Working of Steam Boilers; Functions of Various Boiler Mountings and Accessories; Performance of Boiler parameters and Boiler Draught; Characteristics of flow through steam nozzles; Working of Steam Condensers and their performance; Steam turbines and their analysis; Introduction to gas turbines and jet propulsion.

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

CO1. Demonstrate the knowledge on components of thermal power plant and gas turbines.

CO2. Analyze the components of thermal power plants using thermodynamic cycles and velocity diagrams.

CO3. Provide suitable solutions by analyzing the various components of thermal power generation system.

CO4. Conduct an elementary energy audit and develop heat balance sheet for boilers.

CO5. Use Steam Tables and Mollier Chart in solving complex problems of Thermal Engineering.

DETAILED SYLLABUS:

UNIT - I: BASIC STEAM POWER CYCLE AND STEAM BOILERS
(10 Periods)

Basic Steam Power Cycle: Rankine Cycle-Schematic Layout, Thermodynamic Analysis; Effect of operating variables on the performance, Reheating and Regeneration, Modified Rankine Cycle.

Steam Boilers: Classification of Boilers, Working of Fire Tube Boilers - Simple Vertical Boiler, Cochran Boiler, Cornish Boiler and Locomotive Boiler; Working of Water Tube Boilers - Babcock

and Wilcox Boiler, Lamont Boiler and Benson Boiler; Functions of Boiler Mountings and Accessories.

UNIT - II: PERFORMANCE OF BOILERS AND BOILER DRAUGHT (08 Periods)

Performance of Boilers: Boiler Horse Power, Equivalent Evaporation, Factor of Evaporation and Boiler Efficiency, Heat Balance Sheet.

Boiler Draught: Classification - Natural and Artificial Draught; Chimney Height, Condition for maximum discharge through a chimney, Chimney Efficiency.

UNIT - III: STEAM NOZZLES AND IMPULSE TURBINES (10 Periods)

Steam Nozzles: Classification , functions, Flow of steam through the Nozzles, Velocity of Steam at the exit of Nozzle-Ideal and Actual expansion through the Nozzle; Discharge through the Nozzle - Condition for maximum discharge through the Nozzle, Critical Pressure Ratio; Nozzle Efficiency and Velocity Coefficient, Wilsons Line.

Impulse Turbines: Classification of Steam Turbines, Working of Delaval Impulse Steam Turbine, Stage Velocity diagram and Combined Velocity diagrams, Effect of friction, Axial thrust, Tangential Thrust and Resultant Thrust, Power developed, Diagram Efficiency, Condition for Maximum Diagram Efficiency, Compounding and Governing.

UNIT - IV: REACTION TURBINES AND STEAM CONDENSERS (08 Periods)

Reaction Turbines: Working of Parson's Reaction Turbine, Degree of Reaction, Combined velocity diagram of Reaction Turbines, Condition for Maximum efficiency.

Steam Condensers: Classification, Working of Jet and Surface Condensers, Vacuum Efficiency, Condenser Efficiency, Sources of air, Effect of air leakage in Condenser-Edward's Air Pump; Cooling Water Requirement.

UNIT - V: GAS TURBINES AND JET PROPULSION (09 Periods)

Gas Turbines: Classification of Gas Turbines, Components of simple gas turbine plant-Ideal Gas Turbine Cycle and its deviations with actual cycle; Turbine Work and Efficiency of Simple Gas

Turbine Cycle, Condition for Optimum Pressure Ratio, Methods to improve Turbine Work - Inter cooling and Reheating; Methods to improve efficiency -Regeneration.

Jet Propulsion: Introduction, Classification of Jet Propulsion devices, Working of Air breathing engines- Turbojet Engine, Turbo Prop Engine, Ram Jet Engine and Pulse Jet Engine; Introduction to Rocket Engine.

Total Periods: 45

TEXT BOOKS:

1. R.K.Rajput, *Thermal Engineering*, Laxmi Publication, 9th Edition,2013.

2. R.S.Khurmi & J.S. Gupta, *Thermal Engineering*, S.Chand, 15th Edition, 2015.

REFERENCE BOOKS:

1. V.Ganesan, *Gas Turbines*, TMH, 3rd Edition, 2010.

2. R.Yadav, *Thermodynamics and Heat Engines*, Pearson, 7th Edition, 2007.

III B. Tech. — I Semester

(16BT50306) HUMAN RESOURCE MANAGEMENT
(Interdisciplinary Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Concepts of HRM; Environmental Scanning; Human Resource Planning; Job analysis; Job design; Job evaluation; Recruitment; Selection; Placement; Orientation; Training and Development; Performance appraisal; Merit rating; Compensation; Industrial relations; Trade unions; Industrial disputes; Ethical issues; Employee safety.

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

CO1. Demonstrate the knowledge on the principles, processes and practices of human resource management.

CO2. Analyze the key issues related to administering the human elements such as motivation, recruitment, training and development, compensation, appraisal, and career development.

CO3. Provide solutions to plan and manage human resource functions effectively within organization.

CO4. Apply HRM concepts and techniques in strategic planning to improve organizational effectiveness.

CO5. Evaluate HRM related social, cultural and safe responsibilities and issues in a global context.

CO6. Exercise discernment in following ethical code of conduct in human resource planning.

DETAILED SYLLABUS:

UNIT – I: INTRODUCTION TO HRM & HRP   (09 Periods)

Introduction to Human Resource Management (HRM): Objectives, Scope and Significance of HRM, Functions of HRM, Prospects in HRM, Environmental scanning.

Human Resource Planning (HRP): Introduction, Nature and importance of HRP, Factors affecting HRP, The planning process, Human resource planning and the Government, Requisites for successful HRP, Barriers to HRP.

UNIT – II: RECRUITMENT AND PLACEMENT: (09 Periods)

Job Analysis – Nature and process of job analysis, Methods of collecting job data, Potential problems with job analysis, Requisites for job analysis; Job Design - Factors, Job design approaches, Contemporary issues; Job evaluation - Process, Methods; Recruitment - Nature, Purposes and importance, Factors governing recruitment, Recruitment process, Evaluation and control; Selection – Nature, Process, Barriers to effective selection, Evaluation of selection process, Placement; Separation.

UNIT – III: HUMAN RESOURCE DEVELOPMENT AND COMPENSATION   (09 Periods)

Orientation - Orientation programme, Requisites of an effective programme, Evaluation of orientation programme, Problems of orientation; Training and development – Nature, Inputs, Training process, Methods, Impediments to effective training, Management development, Career development, Talent management; Performance Appraisal - Nature, Appraisal process, Challenges of performance appraisal; Merit rating; Compensation - Philosophy, Components, Theories, Factors influencing employee compensation, Challenges, Wage and salary administration.

UNIT – IV: INDUSTRIAL RELATIONS AND TRADE UNIONS
                              (09 Periods)

Industrial Relations (IR): Nature of IR, Importance of Peaceful IR; Approaches to IR - Unitary Approach, Pluralistic approach, Marxist approach; Parties to IR; IR strategy; Industrial Disputes - Nature, Causes, and Settlement.

Trade unions: Nature of trade unions, Strategic choices before unions, Union tactics, Trade union movement in India, Trends in trade union movement, Managing unions; Indian Factories Act; Employee's compensation Act; Industrial disputes Act.

UNIT – V: ETHICAL ISSUES AND SAFETY ADMINISTRATION
(09 Periods)

Managing Ethical Issues in HRM: Nature of ethics, Sources of business ethics, Myths about ethics, Ethical dilemmas, HR ethical issues, Managing ethics, Improving ethical decision making.

Employee safety: Safety, Need for safety, Types of accidents, Safety programme, ISO safety standards.

Total Periods: 45

TEXT BOOKS:

1. Aswathappa K, *Human Resource Management*, Tata McGraw Hill Private Limited, 7th edition, 2013.

2. Garry Dessler and Biju Varkkey, *Human Resource Management*, Pearson India, 12th Edition, 2011.

REFERENCE BOOKS:

1. Raymond A. Noe, John R. Hollenbeck, *HRM: Gaining a Competitive Advantage*, TMH, 7th edition, 2010.

2. Bohlander George W, Snell Scott, *Principles of Human Resource Management*, Cengage Learning, 16th edition, 2012.

2. Edwin B. Flippo, *Personnel Management*, McGraw-Hill International editions, 6th edition, 1984.

III B.Tech. - I Semester
(16BT50307) INSTRUMENTATION AND CONTROL SYSTEMS
(Interdisciplinary Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Basic Electrical and Electronics Engineering.

COURSE DESCRIPTION: Fundamentals of instrumentation; Static and Dynamic characteristics; Working principle of instruments used for measurement of level and flow; Basic elements of control systems; Electrical analogue of mechanical, thermal, hydraulic and pneumatic systems; Process contol; PID controllers; Data acquisition systems; Programmable Logic Controllers; SCADA system.

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

CO1. Demonstrate the knowledge of fundamentals of instrumentation, measurement and control systems.

CO2. Select the instruments based on the physical considerations for a particular application.

CO3. Build mathematical models of simple physical systems using transfer functions and design logical control systems.

CO4. Investigate the suitable calibration methodology and error analysis related to measuring instruments for real time applications.

CO5. Apply control engineering techniques to the automatic control systems found in modern mechanical systems.

DETAILED SYLLABUS:

UNIT – I: FUNDAMENTALS OF INSTRUMENTATION:

(09 Periods)

Importance of Instrumentation, Types of instruments, Selection of instruments, Static characteristics- Static calibration, Linearity, Static Sensitivity, Accuracy, Static error, Precision,

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SVEC16 - B.TECH - MECHANICAL ENGINEERING

Reproducibility, Threshold, Resolution, Hysteresis, Drift, Span and Range; Dynamic performance characteristics - Sources of error, Classification and Elimination of error; Errors in measurement- Types of errors, Effect of component errors, Probable errors, Performance of instruments; Calibration of Instruments - Methods and analysis; Communication Protocols, Hybrid System – HART Communication; Foundation Field Bus – Introduction and classification.

UNIT — II: MEASUREMENT OF LEVEL AND FLOW

(09 Periods)

Measuremnet of Level: Purpose of level measurement, Vessel characteristics, Categories of level measurement, Direct methods of level measurement – Hook type, Sight glass, Float actuated mechanism; Inferential methods in level measurement- Servo level gauge, Pressure transmitters, Differential head devices, Torque tube displacers, Ultrasonic gauging, Capacitive probes, load cells; Interface level measurement, calibration of level transmitters.

Measurement of Flow: Purpose of measuring flow, Categories of flow measurement, Principles of flow measurement, Working and applications of Magnetic flow meter, Turbine flow meter, Vortex shedding flow meter, Mass flow meter, Ultrasonic flow meter, Flow measurement device selection criteria, Calibration procedures for flow meters.

UNIT - III: CONTROL SYSTEMS: (09 Periods)

Introduction, Basic elements of control system, Open loop control system, Closed loop control system, Manually controlled closed loop systems, Automatic controlled closed loop systems, Basic elements of a servo mechanism - Electrical analogue of mechanical, Thermal, Hydraulic and Pneumatic systems; Transfer functions of elements, systems and processes, Transient and steady state response of control systems, effect of various types of control actions on dynamic performance, Stability of control systems.

UNIT - IV: PROCESS CONTROL (09 Periods)

Process control symbols and hardware components of a control loop, Characteristics of industrial processes – Integrating processes, Inverse acting processes, First order Dead Time Model, PID Controllers – Types, Design, Anaysis, PID controller tuning procedures; Applications of Cascade/feedforward control, Split range control and inferential control.

UNIT - V: DATA ACQUISITION SYSTEMS, PROGRAMMABLE LOGIC CONTROLLERS, SCADA (09 Periods)

Data Acquisition Systems: Basic architecture, Various elements/subsystems of a data acquisition system, General telemetry systems.

Programmable Logic Controllers: Architeture and functionality of PLCs, Different programming languages and operations of PLCs.

SCADA: Basic elements of SCADA systems, SCADA architecture-Monolithic, Distributed, Networked systems.

Total Periods: 45

TEXT BOOKS:

1. K. Padma Raju, Y.J. Reddy, *Instrumentation and Control Systems*, McGraw Hill Education (India) Private Limited, 1st Edition, 2016.

2. Dr.R.K.Rajput, *Mechanical Measurements and Instrumentation (Including Metrology and Control Systems)*, Katson Books, 2nd Edition, 2015.

REFERENCE BOOKS:

1. B.C.Nakra, K.K. Chaudhry, *Instrumentation Measurement and Analysis*, McGraw Hill Education (India) Private Limited, 4th Edition, 2016.

2. I.J. Nagrath and M.Gopal, *Control System Engineering*, New Age International Publishers, 5th Edition, 2007.

III B. Tech. — I Semester
(16BT50308) MECHATRONICS
(Interdisciplinary Elective-1)

Int. Marks   **Ext. Marks**   **Total Marks**   **L**   **T**   **P**   **C**
30   70   100   3   1   -   3

PRE-REQUISITES: Courses on Basic Electrical and Electronics Engineering and Programming in C.

COURSE DESCRIPTION: Mechatronics system; Sensors; Transducers; Actuating systems; DC Motors; Micro controller; Signal Conditioning; Programmable Logic Controllers; Programmable Motion Controllers; Design Approach; Case Studies.

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

CO1. Demonstrate the knowledge on integrative nature of Mechatronics and different components of mechatronics systems.

CO2. Select the appropriate sensors and actuators required for a system by identifying and analyzing real life engineering problems thoroughly.

CO3. Design signal conditioning circuits for mechatronics systems and establish the controlling methods required for that system to meet the specified needs.

CO4. Select, and apply appropriate programmable motion controller techniques and adaptive controllers to complex mechatronics systems with an understanding of the limitations.

CO5. Exhibit the knowledge on design approach, keeping in view of environmental contexts, to reflect the sustainable development.

CO6. Perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct.

DETAILED SYLLABUS:

UNIT - I: MECHATRONICS SYSTEMS   (07 periods)

Definition, Elements of mechatronics System, Mechatronics design process, Measurement systems, Control systems, Examples of Automatic control systems, Advantages and Disadvantages.

UNIT - II: SENSORS AND ACTUATORS   (11 periods)

Sensors: Introduction, Types of transducers and sensors, Characteristic Parameters - static and dynamic; Displacement sensors- Potentiometer, Strain gauge, Linear Variable Differential Transformer; Position sensors- Hall effect sensor, Optical Encoder; Proximity- Inductive, Capacitive; Acceleration- Piezoelectric accelerometer; Temperature- Bimetallic strips, Resistance Temperature Detectors (RTD); Light sensors- photo diodes, photo electric transducer; Selection of Sensors.

Actuators: Hydraulic systems, Pneumatic systems, Control valves, Linear and Rotary actuators, Electrical Actuation systems - Switches, Solenoids, Relays, DC motors, AC motors, Stepper motors.

UNIT - III: SIGNAL CONDITIONG   (10 Periods)

Elements of signal conditioning, Types- Analog, Amplification, Operation Amplifiers; Noise Filters, Bridge circuits, Current-voltage converters, Voltage-frequency converters; Digital signals - Nyquist Sampling theorem, Analog to digital converter, Digital to analog Converter, Data Acquisition System.

UNIT - IV: PROCESS CONTROLLERS   (10 Periods)

Controller principles, Two position controller, Proportional (P) controllers, Integral (I) controllers, Derivative (D) controllers; Composite controller Modes – Proportional Integral (PI), Proportional Derivative (PD), Three mode controller (PID); Selection of controllers, Controller tuning, Adaptive controllers.

UNIT - V: DESIGN OF MECHATRONICS SYSTEMS
(07 periods)

Mechatronics approach to design, Case Studies, Future trends, Ethics as design constraint.

Total Periods: 45

TEXT BOOKS:

1. K.P.Ramachandran, *Mechatronics Integrated Mechanical Electronic Systems*, Wiley, 2012.

2. W. Bolton, Mechatronics *Electronics Control systems in Mechanical and Electrical Engineering*, Pearson, 4th edition, 2005.

REFERENCE BOOKS:

1. N.P. Mahalik, *Mechatronics Principles Concepts and Applications*, McGraw Hill Education (India) Private Limited, 2012.

2. Devdas Shetty, Richard, *Mechatronic System Design*, Cengage Learning, 2nd edition, 2012.

III B. Tech. — I Semester
(16BT40502) DATABASE MANAGEMENT SYSTEMS
(Common to EEE & ME)
(Interdisciplinary Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Database Systems; Database Design; Relational Model; SQL Queries, Constraints and Triggers; Schema Refinement and Normal Forms; Transaction Management; Concurrency Control; Overview of Storage and Indexing.

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

CO1. Demonstrate knowledge on

- Data models and Database Languages
- Database design
- Normal forms
- Storage and Indexing

CO2. Analyze databases using normal forms to provide solutions for real time applications.

CO3. Design solutions for database problems using database design, views design and framing queries.

CO4. Use database techniques for designing databases, managing databases and its security.

CO5. Select SQL, Hash based Indexing and Tree based Indexing to manage data in databases.

CO6. Apply contextual knowledge to develop database applications related to societal applications like Information Retrieval Systems, Banking and Financial systems.

DETAILED SYLLABUS:

UNIT- I: INTRODUCTION TO DATABASE SYSTEMS & DATABASE DESIGN (09 periods)

Database Systems: Database system applications, Purpose of database systems, View of data-Data abstraction, Instances and Schemas, Data models; Database languages - DDL, DML; Database architecture, Database users and administrators.

Database Design: ER diagrams, Beyond ER design, Entities, Attributes and entity sets, Relationships and relationship sets, Additional features of ER model, Conceptual design with ER model.

UNIT-II: THE RELATIONAL MODEL & RELATIONAL ALGEBRA AND CALCULUS (08 periods)

Relational Model: Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design, Introduction to views, Destroying/altering tables and views.

Relational Algebra and Calculus: Preliminaries, Relational Algebra operators; Relational Calculus - Tuple and Domain Relational Calculus; Expressive power of Algebra and calculus.

UNIT-III: SQL & SCHEMA REFINEMENT (10 periods)

SQL: Form of basic SQL query- Examples of basic SQL queries; Nested queries- Introduction to nested queries, Correlated nested queries, Set-comparison operators; Aggregate operators, NULL values-Comparison using NULL values, Logical connectives AND, OR and NOT, Impact on SQL constructs, Outer joins, Disallowing NULL values; Complex integrity constraints in SQL,Triggers and active databases.

Schema Refinement: Problems caused by redundancy, Decompositions, Problem related to decomposition, Functional dependencies, Reasoning about FDS, Normal forms – First, second and third normal forms, BCNF; Multi valued dependencies, Fourth normal form, Join dependencies, Fifth normal form.

UNIT-IV: TRANSACTIONS AND CONCURRENCY CONTROL
(09 periods)

Transactions: Transaction concept, Transaction state, Implementation of atomicity and durability, Concurrent executions, Serializability, Recoverability, Implementation of isolation, Testing for serializability.

Concurrency Control: Lock based protocols, Timestamp based protocols, Validation based protocols, Multiple granularity, Deadlock handling.

UNIT-V: STORAGE AND INDEXING (09 periods)

Storage and Indexing: Data on external storage, File organization and indexing – Clustered indexes, Primary and secondary indexes; Index data structures – Hash based indexing, Tree based indexing; Comparison of file organizations.

Tree Structured Indexing: Intuition for tree indexes, Indexed Sequential Access Method (ISAM), B+ Trees- A dynamic index structure; Search, Insert, Delete; B-Tree index files.

Total Periods: 45

TEXT BOOKS:

1. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, Tata McGraw Hill, 3rd Edition, 2014.

2. A. Silberschatz, H.F.Korth and S. Sudarshan, *Database System Concepts*, Tata McGraw Hill, 5th Edition, 2006.

REFERENCE BOOKS:

1. Ramez Elmasri and Shamkant B. Navathe, *Database Systems*, Pearson Education, 6th Edition, 2013.

2. Peter Rob and Carlos Coronel, *Database Systems Design, Implementation and Management,* Cengage Learing, 7th Edition, 2009.

III B. Tech. — I Semester
(16BT50331)DYNAMICS AND VIBRATIONS LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Course on Dynamics of Machinery.

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

CO1. Demonstrate the working principle of measuring devices used for dynamic testing.

CO2. Analyze the primary and secondary out-of-balance forces in reciprocating machinery.

CO3. Design the experiments to assess the performance of static and dynamic balancing rotating machinery systems.

CO4. Investigate the effect of forces and moments acting on particles and bodies.

CO5. Work in teams in measurement of various parameters of vibration systems.

CO6. Report experimental results, calculations, and inferences systematically.

LIST OF EXPERIMENTS:

1. Determination of Gyroscopic couple on Motorized Gyroscope

2. Determination of the unbalanced couple and forces in

    *   Static and Dynamic Balancing

    *   Balancing of Reciprocating Masses

3. Determination of radius of gyration of a given compound pendulum

4. Determination of the natural frequency of undamped torsional vibration using single rotor shaft system

5. Estimation of the frequency of damped force vibration of a spring mass system

6. Determination of Natural frequency of bending vibration of cantilever beam using FFT analyzer

7. Determination of pressure distribution in journal bearing

8. Determination of moment of inertia of a flywheel

9. Determination of the Coriolis Component of acceleration

10. Determination of critical speed using Whirling of shaft

11. Determination of characteristics of Universal Governor

12. Study of Jump-Off phenomenon in a cam-follower mechanism

III B. Tech. - I Semester
(16BT50332)INTERNAL COMBUSTION ENGINES LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Course on Thermal Engineering-I.

COURSE DESCRIPTION: Calculating the performance parameters of 2-stroke and 4- stroke I.C. Engines; Heat balancing of an engine; Practicing the valve and port timing diagrams; Determining frictional power for single and multi-cylinder engines; Compressor performance. Assembly and disassembly of an automobile models; Determining the Fuel properties;

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

CO1. Demonstrate the theoretical knowledge of Thermal Engineering in finding the Performance of I.C. Engines.

CO2. Analyze the Performance and Exhaust Emissions of an I.C. Engine by conducting various Tests.

CO3. Design and Conduct experiments as well as analyze and interpret the experimental data.

CO4. Conduct investigations on the IC engines for performance improvement and emission reductions.

CO5. Work in teams to achieve common Objectives.

CO6. Report experimental results, calculations, and inferences systematically.

LIST OF EXPERIMENTS

Any TWELVE experiments are to be performed.

1. (a) Valve Timing Diagram using a model of 4–S Diesel, CI engine

    (b)Port timing diagram of a model of 2-S, SI engine

2. Morse Test on 4-S, 4-C, Petrol Engine using Hydraulic Loading

3. Retardation Test on 4-S, 1-C, Diesel Engine using Electrical Loading

4. Performance Test on 2-S, 1-C, Petrol Engine using Electrical Loading

5. Economic speed test on 2-S, 1-C, Petrol Engine using Electrical Loading

6. Performance Test on 4-S, 1-C diesel Engine using Mechanical Loading

7. Heat Balance Test on 4-S, 1-C diesel Engine using Mechanical Loading

8. Performance Test Variable Compression Ratio Engine (VCR Engine)

9. Motoring Test on Variable Compression Ratio Engine (VCR Engine)

10. Performance Test on 2-Stage Reciprocating Air compressor Unit

11. Dismantling / Assembly of Engines to identify the parts and their position in an engine

12. Experiments on Fuels:

    (a) Bomb calorimeter for Calorific Value of Solid and Liquid fuel

    (b) Junker's Gas Calorimeter for Calorific Value of gaseous fuel

    (c) Viscosity measurement using saybolt and redwood viscometer

13. Flue gas analysis for engine emissions using Exhaust Gas Analyser and Smoke Meter

14. Performance Test on Computerized 4-S, 1-C, C.I. engine with Eddy Current loading

15. Demonstration of Vapour Compression Refrigeration System

III B. Tech. – I Semester

(16BT50333) METROLOGY AND INSTRUMENTATION LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Courses on Computer Aided Machine Drawing Lab and Machine Tools and Modern Machining Processes.

COURSE DESCRIPTION: High precision Metrology; Standardization; Calibration of instruments such as Vernier calipers, Micrometer, Vernier height gauge; Measure dimensions of shafts, bearings; Alignment tests on lathes and milling machines; Straightness and flatness measurements; Identifying uncertainties in dimensional metrology; Measurement of gear and threaded profiles; Measurement of level, speed, viscosity, density, humidity, temperature, pressure and discharge coefficient; Data acquisition and analysis using LabVIEW; Data logging and analysis.

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

CO1. Demonstrate the knowledge on measure variables like temperature, pressure, torque, humidity etc. using transducers and gauging instruments for a given system.

CO2. Analyse and select suitable measurement tool and/or measurement system in a practical situation.

CO3. Apply analytical skills to design instrumentation to measure different physical parameters.

CO4. Investigate the sources of measurement errors and eliminate them by use of reference materials to ensure good quality, accurate and traceable measurement results.

CO5. Apply dimensional analysis techniques and use reference values for unit conversions, accurately perform associated mathematics and present final values.

CO6. Function effectively as an individual, and as a member of a team to express the results of measurement and calculations and correctly reflect the effects of measurement uncertainty.

CO7. Document the traceability of measurement standards and specify a dimension validation process.

Any TWELVE experiments to be conducted (SIX from each)

Metrology:

1. (a) Calibration of Vernier Calipers, Micrometer, Vernier Height Gauge, Dial Gauge and measurement of dimensions of components

   (b) Measurement of dimensions of a part using limit gauges

2. (a) Measurement of internal bores by dial bore indicators

   (b) Measurement of coordinates of a jig plate

   (c) Measurement of radius of curvature of a given ring

3. (a) Measurement of angle and taper by using Bevel protractor, Sine bars

   (b) Measurement of angle of Taper plug gauge, Taper ring gauge, V- groove

4. Measurement of gear elements by using Gear Tooth Vernier

5. (a) Measurement of screw elements by using Tool Makers microscope

   (b) Measurement of screw elements by using profilometer

   (c) Measurement of effective diameter of an external thread by using Two Wire/Three wire method

6. (a) Measurement of straightness and flatness using spirit level and Autocollimator

   (b) Measurement of surface roughness using surface roughness tester

7. Checking the limits of dimensional tolerances using electrical and optical comparators

8. Alignment test on lathe and milling machines and measurement of the Resultant force acting on the tool using Tool Dynamometers

Instrumentation:

1. Measurement and calibration of liquid level and analysis of different techniques

2. Measurement of speed and analysis of different techniques

3. Meaurement of viscosity, density, humidity and torques

4. Design of circuit to measure resistance and calibration to respective voltage

5. Calibration and verification of discharge coefficient of orifice plate

6. Measurement of temperature and pressure

7. Data acquisition, calibration and analysis using LabVIEW

8. Data logging and analysis

III B. Tech. – II Semester
(16BT3HS02)MANAGERIAL ECONOMICS AND PRINCIPLES OF ACCOUNTANCY
(Common to ME, CSE, IT & CSSE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Managerial Economics; Demand and Elasticity of Demand; Production Functions; Markets and Pricing Policies; Basic concepts of Accounting (Journal, Ledger and Trial balance); Trading Account, Profit and Loss Account and Balance sheet with simple adjustments; Computerized Accounting.

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

CO1. Acquire Knowledge in

- Tools and concepts of Micro Economics

- Basic Principles and concepts of Accountancy

- Financial Accounting

- Significance of Economics and Accountancy

CO2. Demonstrate analytical skills in managerial decision making of an organization by applying economic theories

CO3. Develop effective communication in Business and Accounting transactions

CO4. Ascertain the profitability and soundness of an organization

CO5. Practice Financial Accounting

DETAILED SYLLABUS:

UNIT – I : INTRODUCTION TO MANAGERIAL ECONOMICS, DEMAND ANALYSIS   (09 Periods)

Definition, Nature and Scope of Managerial Economics. **Demand:** Determinants of demand – Demand function - Law of demand, assumptions and exceptions - Elasticity of demand – Types of

elasticity of demand - Demand forecasting and methods of demand forecasting.

UNIT — II : THEORY OF PRODUCTION AND COST ANALYSIS
(09 Periods)

Production Function: Isoquants and Isocosts – Input-output relationship - Law of returns. **Cost Concepts:** Total, Average and Marginal Cost **-** Fixed vs. Variable costs – Opportunity Costs Vs Outlay Costs– Separable Costs Vs Joint Costs, Urgent Costs Vs Postponable Costs- Avoidable Costs Vs Unavoidable Costs - **Break Even Analysis (BEA)** – Assumptions, Merits and demerits - Determination of Break Even Point (Simple problems).

UNIT — III : INTRODUCTION TO MARKETS AND PRICING
(09 Periods)

Market Structure: Types of Markets - Features of perfect competition - Monopoly and monopolistic competition - Price and Output determination in perfect competition, monopoly and monopolistic Markets.

Pricing : Objectives and policies of pricing – Sealed bid pricing - Marginal cost pricing - Cost plus pricing - Going rate pricing – Penetration Pricing –skimming Pricing - Block pricing – Peak load pricing - Cross subsidization.

UNIT — IV : INTRODUCTION TO PRINCIPLES OF ACCOUNTING & CAPITAL (09 Periods)

Accountancy: Introduction – Concepts – Conventions – Double Entry Book Keeping – Journal – Ledger - Trial Balance (Simple problems).

Capital : Significance - Types of capital – Sources of Capital.

UNIT – V : FINAL ACCOUNTS - COMPUTERIZATION OF ACCOUNTING SYSTEM (09 Periods)

Introduction to Final Accounts - Trading account - Profit and Loss account and Balance Sheet with simple adjustments (Simple problems).

Computerization of Accounting System : Basic Concepts

Total Periods: 45

TEXT BOOKS:

1. A.R. Aryasri, *Managerial Economics and Financial Analysis*, Tata Mc- Graw Hill, New Delhi, 3rd Edition, 2007.

2. Kumar & Rao, *Managerial Economics and Financial Analysis*, Cengage Publications.

REFERENCE BOOKS:

1. Varshaney and Maheswari, *Managerial Economics*, Sultan Chand and Sons, New Delhi, 19th Edition, 2005.

2. R.Cauvery, U.K. Sudhanayak, M. Girija and R. Meenakshi, *Managerial Economics*, S. Chand and Company, New Delhi, 2nd Edition, 2010.

3. S.P. Jain and K.L. Narang, *Financial Accounting*, Kalyani Publishers, Ludhiana, 6th Edition, 2002.

III B. Tech. – II Semester
(16BT60301)**CAD/CAM**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Computer Aided Machine Drawing Lab and Manufacturing Technology.

COURSE DESCRIPTION: Fundamental and conventional CAD processes; Raster scan graphics co-ordinate system; Transformations; Geometric construction models; Curve representation methods; Computer Control in NC; GT; CAPP.

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

CO1. Demonstrate the basic concepts of CAD/CAM to generate a suitable geometric model of an object.

CO2. Analyze the features on an object and develop process planning chart/ part program.

CO3. Model the components and develop part programs for real time applications.

CO4. Evaluate the sequential steps required for computer aided design and manufacturing of components.

CO5. Apply software tools for numerical control of fabrication processes.

CO6. Utilize the safe practices in developing codes for designing and manufacturing components with realistic constraints.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION TO CAD/CAM   (08 Periods)

Computers in Industrial Manufacturing, Computer Aided Design (CAD), Computer Aided Manufacturing (CAM), Computer Integrated Manufacturing (CIM), Design process, Product Life Cycle, CAD Standards-Introduction, classification and Importance of CAD standards.

UNIT – II: COMPUTER GRAPHICS & GEOMTERIC MODELING
(14 Periods)

Computer Graphics: Raster Scan Graphics: DDA Line Algorithm, Bresenham's Line algorithm, Coordinate system, 2D &3D Transformations (Scaling, Translation, Rotation & Reflection).

Geometric Modeling: Requirements of Geometric Modeling, Definition to Parametric and Non-parametric representation , Introduction to curve representation, Analytical and Synthetic curve representation(Bezier, B-spline & Nurbs), Introduction to surface representation (Bezier & B-spline), Introduction to Solid representation methods(B-rep & CSG).

UNIT – III: COMPUTER NUMERICAL CONTROL   (07 Periods)

Introduction to CNC, CNC Hardware basics (Structure of CNC machine tools, Actuation systems, Feedback devices), CNC Tooling (Automatic tool changers, Work holding, CNC Programming-Part Programming fundamentals, Manual part programming methods, Preparatory Functions, Miscellaneous Functions, Canned Cycles.

UNIT - IV: GROUP TECHNOLOGY & COMPUTER AIDED PROCESS PLANNING   (07 Periods)

Group Technology: Introduction, Part Family, Classification and Coding, Types of coding systems, Identification systems (RFID, Barcodes), Group Technology Cells, Benefits of Group Technology.

Computer Aided Process Planning: Retrieval & Generative Computer Aided Process Planning systems, Benefits of CAPP.

UNIT - V: COMPUTER INTERGRATED MANUFACTURING AND COMPUTER AIDED QUALITY CONTROL   (09 Periods)

Computer Intergrated Manufacturing: Introduction, Types of Manufacturing System, CIMS Benefits, Introduction to Rapid Prototyping and its types (SLA, SLS, FDM and 3D printing), Advantages, Limitations and applications of RPT. Introduction to Flexible Manufacturing System.

Computer Aided Quality Control : Introduction, Inspection and Testing, Contact & Non-Contact inspection methods.

Total Periods: 45

TEXT BOOKS:

1. P.N. Rao, *CAD/CAM: Principles and Applications*, TMH, 2004.

2. Michel P.Groover, *Computer Aided Design & Computer Aided Manufacturing*, Pearson Education, 2006.

REFERENCE BOOKS:

1. Ibrahim Zeid, *CAD/CAM Theory and Practice*, Mc Graw Hill, 2010.

2. Radhakrishnan and Subramanian, *CAD/CAM/CIM*, New Age International, 2004.

3. E. Michael, *Geometric Modeling*, John Wiley & Sons, 3rd Edition 2013.

III B.Tech. – II Semester

(16BT60302) HEAT TRANSFER

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Multi-Variable Calculus and Differential Equations, Thermodynamics and Fluid Mechanics.

COURSE DESCRIPTION: Modes of heat transfer; One-dimensional steady and transient conduction; Analysis of extended surfaces; Convection heat transfer; free and forced convection; boiling and condensation; Heat exchangers; radiation; Concept of black body; irradiative heat exchange between surfaces.

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

CO1. Demonstrate the knowledge on the concepts of conduction, convection and radiation heat transfer processes.

CO2. Identify, analyze and formulate heat transfer process for the thermal design of systems.

CO3. Design thermal systems for real time applications.

CO4. Conduct investigations on complex heat transfer problems and provide solutions.

CO5. Use analytical and numerical solution techniques in solving heat transfer problems, including heat generation and extended surfaces

DETAILED SYLLABUS:

UNIT - I: CONDUCTION HEAT TRANSFER   (09 Periods)

Basics of Heat Transfer, Modes and Mechanism of heat transfer, Conduction, convection and radiation, General differential equation of heat conduction - Cartesian, Cylindrical and Spherical Coordinates; Boundary and Initial Conditions, One dimensional steady state heat conduction - Conduction through plane wall, cylinders and spherical systems; Composite systems, Critical thickness of insulation.

UNIT - II: FINS AND TRANSIENT HEAT CONDUCTION
(09 Periods)

Extended surfaces - Efficiency, Effectiveness and Temperature distribution on Long Fin, Fin with Insulated Tip and Short Fin; Unsteady heat conduction - Lumped heat analysis, Infinite and semi infinite solids.

UNIT - III: CONVECTION HEAT TRANSFER   (09 Periods)

Hydrodynamic and thermal boundary layer theory, Dimensional analysis, Buckingham's ð-theorem applied to free and forced convection heat transfer.

Forced convection: External flows - Flow over plates, cylinders and spheres; Internal flows- flow through Horizontal pipe, Annular pipe.

Free convection: Flow over vertical plate, horizontal plate, and cylinders.

UNIT - IV: HEAT EXCHANGERS AND PHASE CHANGE HEAT TRANSFER   (09 Periods)

Heat Exchangers: Classification of Heat Exchangers, Overall Heat Transfer Coefficient and Fouling Factor, Concepts of LMTD and NTU Methods.

Boiling: Pool Boiling Regimes, Determination of Heat Transfer Coefficient in Nucleate Boiling, Critical Heat Flux and Film Boiling.

Condensation: Filmwise and Dropwise Condensation, Nusselt's Theory of Condensation on a Vertical Plate.

UNIT - V: RADIATION HEAT TRANSFER   (09 Periods)

Fundamentals of Radiation, Emission Characteristics and Laws of Black Body Radiation, Irradiation, Total and Monochromatic radiation, Laws of Planck, Wien's displacement, Kirchoff, Lambert's cosine, Stefan and Boltzmann, Radiative Heat Exchange - Heat Exchange between Two Black Bodies, Concepts of Shape Factor, Emissivity, Heat Exchange between Gray Bodies, Radiation Shields.

Total Periods: 45

TEXT BOOKS:

1. R.C. Sachdeva, *Fundamentals of Engineering Heat and Mass Transfer*, New Age International, 4th Edition, 2014.

2. R.K.Rajput, *Heat and Mass Transfer, S.Chand & Company Ltd*, 6th Edition, 2015.

REFERENCE BOOKS:

1. P.K.Nag, *Heat Transfer*, TMH, 2nd Edition, 2010.

2. Holman.J.P, *Heat Transfer*, TMH, 9th Edition, 2010.

3. Yunus Cengel, *Heat and Mass Transfer*, Mc Graw Hill Publications, 4th Edition, 2014.

4. C.P Kothandaraman and S.Subramanyan, *Heat and Mass Transfer data book*, New Age International, 8th Edition, 2014.

Note: Heat Transfer Data Book mentioned in Reference No.4 is needed during examinations.

III B. Tech. — II Semester
(16BT60303) **NON- CONVENTIONAL ENERGY SOURCES**
(Interdisciplinary Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Overview and importance of non-conventional energy sources; Solar Energy collection, solar energy storage and applications; Wind energy conversion; Biomass energy conversion; Geothermal energy Conversion; Ocean energy conversion: Ocean thermal energy conversion, Wave energy and tidal energy conversion.

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

CO1. Demonstrate the knowledge of Non-Conventional energy resources.

CO2. Identify, analyze and formulate requirements for various non-conventional energy conversion systems.

CO3. Propose probable designs for various non-conventional energy conversion systems to solve real time applications.

CO4. Conduct investigations in selection of non-conventional energy conversion systems for a particular geographic region.

CO5. Consider health and safety issues in designing non-conventional energy conversion systems to solve industrial and social problems.

CO6. Optimize the utilization of the natural resources using non-conventional energy conversion systems to reduce the environmental pollution.

DETAILED SYLLABUS:

UNIT - I: ENERGY CONSERVATION AND SOLAR ENERGY
(09 Periods)

Basics of energy sources and Conservation: Classification and potential of energy sources, Importance of renewable

energy sources and energy chain, Principles of energy conservation.

Fundamentals of Solar Energy: Solar constant and solar radiation geometry, Solar time and day length, Estimation of monthly average daily total radiation on horizontal surface and tilted surface, Measurement of solar radiation - Pyranometer, Pyrheliometer and Sunshine recorder.

UNIT - II: SOLAR ENERGY COLLECTION DEVICES
(09 Periods)

Flat plate collector, Losses through flat plate collector - Top loss, Side loss and Bottom loss coefficients; Transmissivity of the cover system, Transmittance – Absorptance product, Parameters affecting the collector performance, Efficiency of flat plate collector, Selective surfaces, Air collectors and types, Classification and types of concentrating collectors.

UNIT - III: SOLAR THERMAL ENERGY APPLICATIONS

(09 Periods)

Solar Thermal Applications: Methods of storing solar energy, Solar water heating, Impact of conventional energy sources on environment, Applications of solar thermal energy: Solar Refrigeration, Solar thermal power generation, Solar distillation, Solar space heating and Space cooling.

Solar Voltaic Systems & Emerging Technologies : Basic principle of PV cell, Arrangements of PV cells, classification of PV cell, Principle of power generation through Magneto Hydro Dynamics, Power thermo electric and thermionic power generation.

UNIT - IV: WIND ENERGY AND BIOMASS ENERGY CONVERSION
(09 Periods)

Wind Energy Conversion: Origin of wind, application of wind power, components and working of horizontal axis wind turbine - Betz limit, Types of blades, upwind and downwind turbines, vertical axis Wind turbines- Savonius type, Darrieus type.

Biomass Energy Conversion: Photosynthesis process, Classification of biogas plants, Types of Digesters - KVIC and

Deenabandhu digesters, Factors affecting digester performance of digester, Gasification.

UNIT - V: GEOTHERMAL AND OCEAN ENERGY CONVERSION
(09 Periods)

Geothermal Energy Conversion: Introduction, geothermal sources - Hydro thermal resources, geopressurized resources, hot dry rocks, Power generation through liquid dominated system, vapour dominated system and hot dry rocks, applications of geothermal energy, environmental consideration.

Ocean Energy Conversion: Ocean thermal Energy conversion - Lambert's law, OTEC. conversion technologies- Claude cycle and Anderson cycle; Tidal energy conversion - Introduction, tidal energy conversion - single basin and double basin systems.

Total Periods: 45

TEXT BOOKS:

1. G.D, Rai, *Non-conventional Energy Sources*, Khanna Publichers, 5th Editon, 2011.

2. B.H.Khan, *Non-conventional Energy Sources*, TMH, 3rd Edition, 2016.

REFERENCE BOOKS:

1. S.P.Sukhatme and J.K Nayak, *Solar Energy Principles of Thermal Collection and Storage*, TMH, 3rd edition, 2008.

2. W.R.Murphy & G.Mckay, *Energy Management*, Butterworth, London, 2nd Edition, 2007.

III B. Tech. - II Semester

(16BT50402) MICROPROCESSORS AND MICROCONTROLLERS

(Interdisciplinary Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Basic Electrical and Electronics Engineering.

COURSE DESCRIPTION: Architecture, Instruction set and programming of 8086; Programmable interfacing devices - architecture and programming; Interfacing Memory and I/O devices with 8086; 8051 Microcontroller - Architecture, programming, interrupts and applications.

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

CO1. Demonstrate knowledge in

- Internal hardware details of Intel 8086, 8051 and programmable devices like 8255, 8251, 8259, 8257.
- Interfacing various peripherals to build stand alone systems.

CO2. Critically analyze the requirements to meet the specifications of microprocessors and microcontrollers based systems.

CO3. Design and develop suitable interfaces for real time applications.

CO4. Exhibit programming skills, choose suitable hardware and program the devices to solve Engineering problems.

CO5. Apply appropriate techniques, resources to complex engineering activities for modeling microcomputer and microcontroller based systems with understanding of limitations.

CO6. Apply concepts of microprocessors and microcontrollers for solving societal problems.

DETAILED SYLLABUS:

UNIT - I: 8086 ARCHITECTURE AND PROGRAMMING
(10 Periods)

Microprocessor Evolution, Review of Intel 8085, 8086 internal Architecture - register organization, memory segmentation, memory organization; Introduction to programming the 8086 - Assembler directives, addressing modes, instruction set, simple programs, procedures and macros.

UNIT - II: 8086 INTERFACING AND INTERRUPTS
(08 Periods)

Pin description, minimum & maximum mode operation of 8086, timing diagram. Interfacing memory (RAM and EPROM) to 8086. 8086 Interrupts - types and interrupt responses, Interrupt vector table, priority of interrupts; 8259 priority interrupt controller - architecture, system connections and cascading, initialization of 8529.

UNIT - III: PROGRAMMABLE DATA COMMUNICATION DEVICES
(11 Periods)

Introduction to serial and parallel communication, methods of parallel data transfer. 8255 PPI - Internal architecture and system connections, operational modes and initialization, interfacing stepper motor, ADC, DAC, Optical Shaft Encoder; Methods of serial data transfer, 8251 USART - architecture and its initialization, sending and receiving characters; Serial communication standard - RS232C, USB; Architecture and operation of 8257 DMA controller.

UNIT - IV: MICROCONTROLLERS AND PROGRAMMING
(08 Periods)

Microcontroller Vs General purpose microprocessor, 8051/8052 Microcontroller – architecture, features, register organization, pin diagram, internal and external memories & their interfacing, instruction set, addressing modes, simple programs.

UNIT - V: 8051 INTERFACING   **(08 Periods)**

Timer/Counters – Registers, modes and programming; Serial communication – registers, programming 8051 for serial communication; Interrupts – registers, programming; 8051 applications – Interfacing key board, LEDs and LCD.

Total Periods: 45

TEXT BOOKS:

1. Douglas V. Hall, *Microprocessors and Interfacing: Programming and Hardware*, Tata McGraw-Hill, revised 2nd Edition, 2006.

2. Mazidi and Mazidi, *The 8051 Microcontroller and Embedded Systems*, Prentice Hall of India, 2000.

REFERENCE BOOKS:

1. A.K. Ray and K.M. Bhurchandi, *Advanced Microprocessors and Peripherals- Architecture*, Programming and Interfacing, Tata McGraw Hill, 2002 Reprint.

2. Kenneth J. Ayala, *The 8051 Microcontroller*, Thomson Delmar Learning, 3rd Edition, 2004.

III B. Tech. – II Semester
(16BT41202) JAVA PROGRAMMING
(Interdisciplinary Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Programming in C.

COURSE DESCRIPTION: Introduction of Java, Classes and Objects; Inheritance, Packages, Interfaces; Exception handling, Multithreading; Event handling, AWT, Collection Classes; Applets, Servlets.

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

CO1. Demonstrate knowledge on:
- Object Oriented Programming concepts - classes, objects, inheritance, polymorphism, encapsulation and abstraction.
- Packages, interfaces, multithreading, exception handling, event handling.

CO2. Analyze complex engineering problems using object oriented concepts.

CO3. Design and develop reusable code to provide effective solutions for real world problems using inheritance and polymorphism.

CO4. Apply AWT and Applets to create interactive Graphical User Interfaces.

CO5. Use advanced programming languages to develop web applications.

CO6. Build Java Applications suitable for societal requirements.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION   **(10 Periods)**

Data types, Variables, Arrays, Operators, Control statements.

Classes and Objects: Concepts of Classes, Objects, Constructors, Methods, this keyword, Garbage collection, Overloading Methods and Constructors, Parameter passing, Access control, Recursion, String Class.

UNIT-II: INHERITANCE, PACKAGES AND INTERFACES
(09 Periods)

Inheritance: Inheritance basics, Super keyword, Multi-level hierarchy, Abstract classes, Final keyword with inheritance.

Packages: Definition, Creating and accessing a package, Understanding CLASSPATH, Importing packages.

Interfaces: Definition, Implementing interfaces, Nested interfaces, Applying interfaces, Variables in interface and Extending interfaces.

UNIT-III: EXCEPTION HANDLING AND MULTITHREADING
(08 Periods)

Exception Handling: Concepts of exception handling, Exception types, Usage of Try, Catch, Throw, Throws and Finally, Built in exceptions, Creating own exception sub classes.

Multithreading: Java thread model, Creating threads, Thread priority, Synchronizing threads, Inter-thread communication.

UNIT-IV: COLLECTION CLASSES, THE APPLET CLASS AND AWT
(10 Periods)

Collection Classes: ArrayList Class, LinkedList Class, Hashset Class, LinkedHashSet Class, TreeSet Class, PriorityQueue Class, EnumSet Class.

The Applet Class: Types of applets, Applet basics, Applet architecture, Applet skeleton, Passing parameters to applets.

AWT Control Fundamentals: User interface components, Layout managers.

UNIT-V: EVENT HANDLING AND SERVLETS   (08 Periods)

Delegation event model: Event classes, Event Listener Interfaces – Mouse and Key; Adapter classes.

Servlets: Life cycle of a servlet, Using Tomcat for Servlet development, Create and compile the servlet source code, Servlet API, Javax.Servlet package.

Total Periods: 45

TEXT BOOK:

1. Herbert Schildt, *Java the Complete Reference*, Oracle Press, 9th Edition, 2014.

REFERENCE BOOK:

1. Sachin Malhotra and Saurab Choudhary, *Programming in Java*, Oxford University Press, 2nd Edition, 2014.

III B. Tech. — II Semester
(16BT51201) **COMPUTER GRAPHICS AND MULTIMEDIA**
(Interdisciplinary Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Matrices and Numerical Methods.

COURSE DESCRIPTION: Introduction to Computer Graphics, Output Primitives; 2D Geometric Transformations and Viewing; 3D object representation and Visible Surface Detection Methods; Introduction to Multimedia, Audio and Video; Multimedia Data Compression.

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

CO1. Demonstrate knowledge on:

- Graphical interactive devices

- Viewing transformations

- 3-D object representations

- Surface detection methods

- Image, audio, video representations and standards.

CO2. Analyze multimedia compression issues using image, audio and video compression techniques.

CO3. Design algorithms to generate points, lines, polygons for 2-D, 3-D objects.

CO4. Apply Transformations and Clipping algorithms for 2-D and 3-D objects, various lossy/ lossless coding techniques on text and images for compression and decompression.

CO5. Build multimedia applications for societal requirements.

DETAILED SYLLABUS:

UNIT –I: INTRODUCTION TO GRAPHICS AND OUTPUT PRIMITIVES **(09 Periods)**

Introduction: Raster-Scan systems, Random Scan systems, Graphics monitors, Work stations and Input devices.

Output Primitives: Points and Lines, Line Drawing algorithms, Mid-point Circle and Ellipse algorithms.

Filled area primitives: Scan Line Polygon Fill algorithm, Boundary-fill algorithms and Flood-Fill algorithms.

UNIT –II: 2-D GEOMETRICAL TRANSFORMS AND 2-D VIEWING **(09 Periods)**

2-D Transforms: Translation, Scaling, Rotation, Reflection and Shear transformations, Homogeneous coordinates, Composite Transforms, Transformations between coordinate systems.

2-D Viewing: The Viewing Pipeline, Viewing coordinate reference frame, Window to View-Port coordinate Transformation, Cohen-Sutherland line clipping algorithms.

UNIT –III: 3-D OBJECT REPRESENTATION AND VISIBLE SURFACE DETECTION METHODS **(09 Periods)**

3-D Object representation: Polygon Surfaces, Quadric surfaces, Spline Representation, Hermite Curve, Bezier Curve and B-Spline Curves, Bezier and B-Spline Surfaces.

Visible Surface Detection Methods: Classification, Back-Face detection, Depth-Buffer, Scan-Line, Depth Sorting, BSP-Tree methods, Area Sub-Division and Octree methods.

UNIT-IV: INTRODUCTION TO MULTIMEDIA, AUDIO AND VIDEO **(09 Periods)**

Introduction: Definition of Multimedia, Multimedia and Hypermedia, Multimedia Software tools, Graphics and Image Data representations-Graphics and Image Data types, File Formats, Color models in images, Color models in video.

Audio and Video: Definition of sound, Digitization, Nyquist Theorem, Signal to Noise ratio, Signal to Quantization-Noise ratio; Types of video signals, Analog video, Digital video.

UNIT-V: MULTIMEDIA DATA COMPRESSION   (09 Periods)

Lossless compression algorithms- Introduction, Basics of Information Theory, Run Length Coding, Variable Length coding, Dictionary Based coding, Arithmetic coding; Lossy Compression algorithms- Quantization; Introduction to Transform Coding- DCT, DFT; Image compression techniques-JPEG standard, JPEG 2000; Introduction to video compression- Video compression based on Motion Compensation, MPEG-1, MPEG-2.

Total Periods: 45

TEXT BOOKS:

1. Donald Hearn and M. Pauline Baker, *Computer Graphics C version*, Pearson Education, 2nd Edition, 2006.

2. Ze-Nian Li and Mark S. Drew, *Fundamentals of Multimedia*, Pearson Education, 2nd Edition, 2008.

REFERENCE BOOKS:

1. James D. Foley, Andries van Dam, Steven K. Feiner and John F. Hughes, *Computer Graphics: Principles and Practice in C*, Addison Wesley Professional, 2nd Edition, 2013.

2. Nigel Chapman and Jenny Chapman, *Digital Multimedia*, Wiley Dreamtech, 2nd Edition, 2004.

III B. Tech. – II Semester
(16BT60304) GAS TURBINES AND JET PROPULSION
(Program Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Thermal Engineering - II

COURSE DESCRIPTION: Jet propulsion gas turbine; Engine types; Performance; Turbojet and turbofan engines; Design of Compressor; Combustor and Turbines; Jet and Rocket propulsions.

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

CO1. Demonstrate the knowledge on gas turbines, Jet and Rocket propulsion systems.

CO2. Identify, Analyze and formulate the performance of components in the engine.

CO3. Design the propulsion systems with an influence on engine output considering the required parameters for a particular gas turbine engine.

CO4. Investigate and carry out a cyclic analysis of a gas turbine engine, including ramjet and turbofan.

CO5. Utilize appropriate analytical methods in integrating the engine into an aircraft system for better performance analysis.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION & ANALYSIS OF GAS TURBINE CYCLES   **(09 Periods)**

Development of gas turbine, Classification of gas turbines, Gas turbine vs. reciprocating I.C. engine, Gas turbine vs steam turbine, Applications of gas turbines, the basic cycle Analysis of simple gas turbine cycle, Effect of thermodynamic variables on the performance of simple gas turbine plant, Improvements in simple gas turbine cycle, Actual gas turbine cycle, Closed cycle gas turbine, Helium cooled, closed gas turbine for nuclear power plants , Total energy system incorporating gas turbine, Semi-closed cycle gas turbine, Gas turbine plant arrangement.

UNIT - II: COMPRESSOR AND TURBINES   (09 Periods)

Centrifugal and Axial flow compressors, Blowers and Fans, Theory and design of impellers and Blading, Axial flow turbines, Blade diagrams and Design of blading, Performance characteristics, Matching of turbines and compressors.

UNIT - III: GAS TURBINE COMBUSTION CHAMBER
(08 Periods)

Introduction, Requirements, Combustion process in gas turbine, Types of combustion chamber, Flow pattern in a combustion chamber, Performance and operating characteristics of combustion chambers, Fuel injection in combustion chamber.

UNIT - IV: JET PROPULSION   (09 Periods)

Introduction, Thrust, Thrust vs. thrust horse power, Efficiencies, Airscrew, Turbojet, Thrust augmentation, Turboprop engine, Bypass and ducted fan engines, Regenerative ducted fan engine, Turbo shaft engine, Ram jet, Pulsejet, Comparison of various propulsion devices.

UNIT - V: ROCKET PROPULSION   (10 Periods)

Introduction, classification of rockets, Principle of rocket propulsion, Analysis of an ideal chemical rocket, Optimum expansion ratio for rocket, The chemical rocket, Advantages of liquid propellant rockets over solid propellant rockets, Free radical Propulsion, Nuclear Propulsion, Ion propulsion, Plasma propulsion.

Total Periods: 45

TEXT BOOKS:

1. Mathur, M., and Sharma, R.P., *Gas Turbines and Jet & Rocket Propulsion*, Standard Publishers, New Delhi, 2014.

2. Ganesan, V., *Gas Turbines*, Tata McGraw Hill Book Company, New Delhi, 3rd edition, 2010

REFERENCE BOOKS:

1. Yahya. S.M., *Fundamental of Compressible Flow with Aircraft and Rocket Propulsion*, New Age International (p) Ltd., New Delhi, 2005.

2. Cohen.H., Rogers R.E.C and Sravanamutoo, *Gas Turbine Theory*, Addison Wesley Ltd., 1987.

3. Rathakrishnan. E., *Gas Dynamics*, Prentice Hall of India, New Delhi, 1st Edition, 2001.

III B. Tech. – II Semester
(16BT60305) HYDRAULICS AND PNEUMATICS
(Common to ME & EIE)
(Program Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Fluid Mechanics and Basic Electrical and Electronics Engineering

COURSE DESCRIPTION: Basic fluid power system; Hydraulic components and its use; Hydraulic circuits and its application; Fundamentals of pneumatics; Pneumatic components and its use; Pneumatic circuits; Application; Design of hydraulic and pneumatic systems for various applications; Electro Pneumatics; Logic gates.

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

CO1. Demonstrate the basic mechanism of fluid power systems and automation.

CO2. Identify and analyze engineering problems in automated environment.

CO3. Design the pneumatic and hydraulic circuits for domestic and industrial problems.

CO4. Investigate the issues related to the design and manufacture of pneumatic and hydraulic systems.

CO5. Use modern tools available in automation to enhance the productivity.

CO6. Deploy the best way of implementing the automation to have eco-friendly environment and sustainable development.

DETAILED SYLLABUS:

UNIT - I: FUNDAMENTALS OF HYDRAULIC POWER SYSTEMS.
(08 Periods)

Fluid Power Fundamentals, Advantages and Application. Pascal's law, Viscous oils, properties. Components of hydraulic systems-Pumps, Gear pump, Vane pump, and Piston pump; Pumping theory, Actuators –Single acting, Double acting, Tandem, Rod less; Accumulators, Intensifiers.

UNIT - II: HYDRAULIC CONTROL COMPONENTS AND DESIGN OF CIRCUITS (09 Periods)

Directional control valves (DCVs), Pressure control valves, Flow control valves, Shuttle valve, Check valve, Sequence valve, Solenoid valve, and Relay, ISO/ANSI symbols, Simple hydraulic circuits, ladder diagram.

UNIT - III: FUNDAMENTALS OF PNEUMATICS (09 Periods)

Pneumatic system components, Compressors, Filters, Regulator, Lubricator unit (FRL UNIT), Driers, Valves, Pressure control valve, Flow control valve, Quick exhaust valve, direct control valves, Time delay valve, Memory valve, Shuttle valve, Twin pressure valve, Solenoid valves and Pneumatic cylinders, ISO/ANSI symbols.

UNIT - IV: DESIGN OF PNEUMATIC CIRCUITS (10 Periods)

Pneumatic circuits, Speed control circuits, Multi- Cylinder Application by Coordinated and sequential motion control, Motion and control diagrams, Cascading method- principle, and Practical application (up to two cylinders)

UNIT - V: ELECTRO PNEUMATICS AND LOGIC GATES (09 Periods)

Electro- Pneumatic: Principles - Signal input and output, Pilot assisted solenoid control of directional control valves, Use of relay and contactors.

Logic Gates: Introduction and use of Logic gates in pneumatic applications, Practical Examples.

Total Periods: 45

TEXT BOOKS:

1. Srinivasan.R, *Hydraulic and Pneumatic controls*, McGraw Hill Education, 2nd Edition, 2006.

2. Shanmugasundaram. K, *Hydraulic and Pneumatic Controls*, S. Chand & Co, 1st Edition, 2006

REFERENCE BOOKS:

1. Majumdar S.R., *Oil Hydraulics Systems Principles and Maintenance,* McGrawHill Education, 1st Edition, 2000.

2. Majumdar S.R., Pneumatic systems – Principles and Maintenance, McGraw Hill Education, 2nd Edition, 2001.

III B. Tech. — II Semester
(16BT60306) MECHANICAL VIBRATIONS
(Program Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Dynamics of Machinery.

COURSE DESCRIPTION: Basics of vibration; Analysis of two or more degrees of freedom; Multi-body mechanical systems; Undamped free vibrations; Damped free vibration; Forced vibrations; Basic concepts on engineering measurements; Spectrum analysis; signal processing; vibration control.

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

CO1. Demonstrate knowledge on Vibration and its practical applications.

CO2. Analyze the mathematical models of the system and provide a qualitative assessment of the vibrations present in the system.

CO3. Design the possible sources of unwanted vibration and suggest means of rectification.

CO4. Investigate the complex system by analyzing the sub-systems and using their models for quicker solutions.

CO5. Use the different tools involved in Vibration Control to enhance productivity.

CO6. Relate the issue of safety in dynamic systems involving moving parts and propose solutions for society.

DETAILED SYLLABUS:

UNIT - I: FUNDAMENTALS OF VIBRATIONS   (09 Periods)

Single degree of Freedom Systems – Definition, Classification and terminology; Simple harmonic motion and Mathematical modeling, Natural vibrations – Equilibrium method, Energy method; Equivalent systems –Damped free vibration, Springs in parallel and series.

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UNIT - II: FORCED VIBRATIONS   (09 Periods)

Constant harmonic excitation - steady state forced vibration, Impressed harmonic force, Impressed force due to unbalance; Motion excitation – amplitude, absolute, relative, Rotating with reciprocating unbalance; Transmissibility and Isolation – Force and Motion transmissibility; Damping – coulomb damping, Viscous damping.

UNIT - III: TWO DEGREE FREEDOM SYSTEMS   (09 Periods)

Free vibrations of spring coupled systems - Natural frequencies and modes of vibration by classical method of spring-mass system; Forced vibration - Dynamic vibration absorber, longitudinal vibrations of bars;

UNIT - IV: TORSIONAL SYSTEMS   (09 Periods)

Introduction, Torsional system, Damped mass and distributed mass systems, Natural frequencies and mode shapes - Rayleigh's method, Holzer method, Stodola method.

UNIT - V: VIBRATION MEASUREMENTS   (09 Periods)

Vibration measurement - process, classification of measuring instruments; Vibrometers- Stylus type, optical type, seismic instrument, simple potentiometer; capacitance pick-up- Active type and passive type pick-ups; Accelerometers- FFT Spectrum analyzer and its applications; Vibration monitoring technique.

Total Periods: 45

TEXT BOOKS:

1. G.K.Groover, S.P. Nigam, *Mechanical Vibrations*, Nemchand & Brother's, 8th Edition 2008

2. V.P.Singh, *Mechanical Vibrations*, Dhanpat Rai & Co. Pvt. Ltd., 4th Edition, 2014.

3. S.S.Rao, *Mechanical Vibrations*, Pearson Publication. 4th Edition, 2003.

REFERENCE BOOKS:

1. W.T. Thompson, *Theory of Vibration with Applications*, Prentice Hall, 5th Edition, 2008.

2. Sadhu Singh, *Mechanical vibrations and Noise control*, 13th Edition, Dhanpat Rai & Sons.

3. Meirovitch, *Elements of Vibration analysis*, McGraw Hill Education (India) Pvt. Ltd., 1st Edition 2013.

4. Timoshenko and Young, *Vibration Problems in Engineering*, Wolfe den Press

III B. Tech. - II Semester
(16BT60307) SUPPLY CHAIN MANAGEMENT

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Industrial Engineering and Management.

COURSE DESCRIPTION: Fundamentals of supply chain management; Supply Chain Decisions; Achieving Strategic fit; Drivers of Supply Chain; Inventory management in a supply chain; Supply chain integration; Distribution Resources Planning; Bullwhip Effect; Role of information technology in SCM; Designing and planning transportation networks through infrastructure and strategies; International and Contemporary issues in SCM; Demand and Supply planning; Mass customization; Global issues and Outsourcing problems; Supply Chain Operations Reference Model; Third party logistics; Retailer-Supplier Partnership; Metrics and Emerging trends in SCM.

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

CO1. Demonstrate the knowledge on the supply chain management concepts including supplier relationships, and optimization approaches.

CO2. Analyze and identify the key drivers and enablers of SCM for a given firm.

CO3. Propose appropriate and customized strategies and policies for managing supply chain of the firm and implement the same.

CO4. Investigate the issues in managing supply chains and give appropriate solutions that cater the needs of a particular organization.

CO5. Use internet technologies to enhance productivity of the firm through better SCM practices.

DETAILED SYLLABUS:

UNIT – I: INTRODUCTION TO SCM   (09 Periods)

Supply Chain - Definition, Objectives; Global optimization, Importance of Supply Chain Decisions, Decision Phases in a

Supply Chain and Importance of supply chain, SCM and objectives of SCM, Competitive and Supply Chain Strategies, Achieving Strategic fit, Obstacles to achieve strategic fit, Supply Chan Drivers - Inventory, Information, Transportation and Facilities.

UNIT – II: INVENTORY MANAGEMENT IN SCM (09 Periods)

Economic lot size model, Effect of demand uncertainty, Risk pooling, centralized and decentralized system, Managing inventory in the supply chain, Distribution Channel Management, Distribution Resource Planning (DRP).

UNIT – III: VALUE OF INFORMATION   (09 Periods)

Bullwhip effect, Information and supply chain technology, Supply chain integration- Push, Pull and push-pull system; Demand driven strategies, Role of Information Technology in SCM - Impact of internet on SCM; Decision support systems for SCM - Goals, Standardization and Infrastructure.

UNIT – IV: DESIGNING AND PLANNING TRANSPORTATION NETWORKS   (09 Periods)

The role of transportation in a Supply chain, Modes of transportation and their performance characteristics, Transportation infrastructure and Policies, Design options for a transportation network, Trade-offs in transportation design, Tailored transportation.

UNIT – V: INTERNATIONAL & CONTEMPORARY ISSUES IN SCM (09 Periods)

Demand and Supply planning, Mass customization, Global issues and Outsourcing problems, aligning the Supply Chain with Business Strategy – Supply Chain Operations Reference (SCOR) Model, Third party logistics; Retailer-Supplier Partnership, Distributors integration, Supply Chain Management Metrics, Enterprise Resource Planning, Emerging trends in SCM.

Total Periods: 45

TEXT BOOKS:

1. Sunil Chopra & Peter Meindl, *Supply Chain Management - Strategy*, Planning & Operation, Pearson Education, 6th Edition, 2016.

2. Janat Shah, *Supply Chain Management: Text and Cases*, Pearson Education, 1st Edition, 2009.

REFERENCE BOOKS:

1. Thomas E Vollman and Clay Whybark D, *Manufacturing Planning and Control for Supply Chain Management*, Tata McGraw Hill, 5th Edition, 2005.

2. Simchi – Levi Davi, Kaminsky Philip and Simchi-Levi Edith, *Designing and Managing the Supply Chain*, Tata McGraw Hill, 3rd Edition, 2008.

III B. Tech. — II Semester
(16BT6HS01) **BANKING AND INSURANCE**
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITE: —

COURSE DESCRIPTION: Functions of Banking; Role & Functions of RBI; Bank-Customer Relationship; Deposit and Loan Services of Banks; Banking Procedures; Electronic Payment Mechanisms; Business Models; Concepts of Risk and Uncertainty; Fundamentals of Insurance; Principles of Insurance; Functions of Insurance; Insurance players in India.

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

CO1. Demonstrate Knowledge in

- Tools and concepts of Banking and Insurance
- Basic Principles and concepts of Insurance and Banking
- E-fund transfers, e-payments and e-business models

CO2. Develop skills in providing solutions for

- Online banking and e – payments…
- Risk Management through insurance benefits the society at large.
- Money management by leveraging on technology, banking and insurance services.

CO3. Designing software and IT solutions based on banking and business models.

CO4. Provide life-long learning for effective utilization of Banking and Insurance facilities.

DETAILED SYLLABUS:

UNIT – I : INTRODUCTION TO BANKING   (09 Periods)

Meaning and functions of banking, importance of banking, Reserve Bank of India- Functions.

UNIT – II: BANK-CUSTOMER RELATIONSHIP   (09 Periods)

Debtor-creditor relationship, deposit products or services, payment and collection of cheques. Accounts – Types of accounts, procedure for opening and closing an account. Loans and Advances- Principles of lending, Types of loans.

UNIT – III: BUSINESS MODELS & ELECTRONIC PAYMENT SYSTEM   (09 Periods)

Features, types of e-payment system, e-cash, NEFT, RTGS, Credit cards, Electronic Wallet and Debit cards.   Business models- B2B, B2C, C2C, and B2G.

UNIT – IV: INTRODUCTION TO RISK AND INSURANCE
(09 Periods)

Concept of risk, risk Vs uncertainty. Insurance definition, Insurance as risk mitigation mechanism, elements of insurance.

UNIT – V: INSURANCE OVERVIEW   (09 Periods)

Principles of insurance, insurance types, LIC & GIC, insurance - functions, IRDA, Insurance Players in India.

Total Periods: 45

TEXT BOOKS:

1.   A.V. Ranganadha Chary, R.R. Paul, *Banking and Financial system*, Kalyani Publisher, New Delhi, 2nd Edition.

2.   P.K.Gupta, *Insurance and Risk Management*, Himalaya Publishing House, New Delhi.

REFERENCE BOOKS:

1.   Diwan, Praq and Sunil Sharma, *Electronic Commerce- A Manager's Guide to E-Business*, Vanity Books International, Delhi, 2002.

2.   Kalakota Ravi and Whinston Andrew B, *Frontiers of Electronic Commerce*, Pearson Education India, 1996 New Delhi.

3.   Schneider, Grey P, *Electronic Commerce, Course Technology*, Cengage Learning, 8th Edition, New Delhi, 2008.

III B. Tech. – II Semester
(16BT6HS02) BUSINESS COMMUNICATION AND CAREER SKILLS
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Nature and scope of communication; corporate communication; writihng business documents; careers and resumes; interviews.

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

CO1. Demonstrate knowledge in

- Corporate Communication
- Main Stages of Writing Messages
- Career Building

CO2. Analyze the possibilities and limitations of language in

- Communication Networks
- Crisis Management/Communication

CO3. Design and develop the functional skills for professional practice in

- Business Presentations & Speeches

CO4. Apply written and oral communication techniques in preparing and presenting various documents in technical writing.

CO5. Function effectively as an individual and as a member in diverse teams.

CO6. Communicate effectively with the engineering community and society in formal and informal situations.

DETAILED SYLLABUS:

UNIT – I: NATURE AND SCOPE OF COMMUNICATION
(09 Periods)

Introduction: Functions of Communication – Roles of a Manager – Communication Basics –Communication Networks – Informal Communication – Interpersonal Communication –Communication Barriers

UNIT – II: CORPORATE COMMUNICATION   (09 Periods)

Introduction: What is Corporate Communication? – Corporate Citizenship and Social Responsibility – Corporate Communication Strategy – Crisis Management/Communication – Cross-Cultural Communication.

UNIT – III: WRITING BUSINESS DOCUMENTS (09 Periods)

Introduction: Importance of Written Business Communication, Types of Business Messages – Five Main Stages of Writing Business Messages – Business Letter Writing – Effective Business Correspondence – Common Components of Business Letters – Strategies for Writing the Body of a Letter

UNIT – IV: CAREERS AND RESUMES   (09 Periods)

Introduction – Career Building – Business Presentations and Speeches – Resume Formats – Traditional, Electronic and Video Resumes – Sending Resumes – Follow-up Letters – Online Recruitment Process

UNIT – V: INTERVIEWS   (09 Periods)

Introduction – Fundamental Principles of Interviewing – General Preparation for an Interview – Success in an Interview – Types of Interviewing Questions – Important Non-verbal Aspects – Types of Interviews – Styles of Interviewing

Total Periods: 45

TEXT BOOK:

1. Meenakshi Raman and Prakash, *Singh Business Communication*, Oxford University Press, New Delhi, Second Edition, 2012.

REFERENCE BOOKS:

1. Neera Jain and Sharma Mukherji, *Effective Business Communication*, Tata Mc Graw-Hill Education, Pvt. Ltd., New Delhi, 2012.

2. Courtland L.Bovee et al., *Business Communication Today*, Pearson, New Delhi, 2011.

3. Krizan, *Effective Business Communication*, Cengage Learning, New Delhi, 2010.

4. R.K. Madhukar, *Business Communication*, Vikas Publishing House Pvt. Ltd., New Delhi, 2005.

III B. Tech. – II Semester
(16BT6HS03) COST ACCOUNTING AND FINANCIAL MANAGEMENT
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITE: —

COURSE DESCRIPTION: Scope, Objectives and Elements of cost Accounting; Cost Sheet and Tender quotations; Variance Analysis: Material variances, Labor variances; Meaning and Scope, Liquidity, Profitability Ratios: concept of Risk and Return on Investment.

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

CO1. Acquire Knowledge in

- Elements of Costing.
- Basic concepts of Financial Management.
- Risk and Return
- Cost Accountancy
- Capital Budgeting

CO2. Develop skills in

- Material, Labor, Overheads control.
- Cost Control

CO3. Develop effective Communication in Cost Accountancy and Financial Management.

CO4. Design solutions for effective investment decisions.

DETAILED SYLLABUS:

UNIT - I : INTRODUCTION TO COST & COST ACCOUNTING
(09 Periods)

Cost and Cost Accounting, Scope, Objectives, Advantages and disadvantages – Cost Accounting Vs Management Accounting

– Elements of Costing – Installation of costing system – Material Control, Labour Control, Overhead Control.

UNIT - II: COST SHEET & PREPARATION OF COST SHEET
(09 Periods)

Analysis of Cost – Preparation of cost sheet, estimate, tender and quotation (Simple problems) – Importance of Costing while pricing the products.

UNIT - III: STANDARD COSTING & VARIANCE ANALYSIS
(09 Periods)

Introduction to Standard Costing & Variances – Variance Analysis: Material variances, Labour variances (Simple Problems).

UNIT - IV : INTRODUCTION TO FINANCIAL MANAGEMENT & RATIO ANALYSIS
(09 Periods)

Financial Management-Meaning and Scope, Liquidity, Profitability, Financial Statement Analysis through ratios (Simple Problems).

UNIT - V: INTRODUCTION TO INVESTMENT
(09 Periods)

Investment-Meaning and Definition- concept of risk and returns- Investment Alternatives- Capital Budgeting techniques – Security Analysis and Portfolio Management (Basic concepts).

Total Periods: 45

TEXT BOOKS:

1. S.P. Jain and K.L. Narang, *Cost Accounting*, Kalyani Publishers, Ludhiana, 6th Edition, 2002.

2. I.M. Pandey, *Financial Management*, Vikas Publishing House Pvt. Ltd., 10th Edition, 2010, ISBN- 13 9788125937142.

REFERENCE BOOKS:

1. The Institute of Company Secretaries of India, *Cost and Management Study Material*, New Delhi.

2. James C Van Horne, *Financial Management and Policy*, Prentice-Hall of India/Pearson, 12th Edition, 2001 ISBN-10: 0130326577.

III B. Tech. – II Semester
(16BT6HS04) ENTREPRENEURSHIP FOR MICRO, SMALL AND MEDIUM ENTERPRISES
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITE: —

COURSE DESCRIPTION: Introduction to Entrepreneur Development; Idea generation and formation of Business Plan; Micro and Small Enterprises; Institutional Finance and Support to Entrepreneur; Woman Entrepreneurship.

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

CO1. Acquire Knowledge in

- Basic Principles and concepts of entrepreneurship.
- Significance of entrepreneurship.
- Schemes and institutions encouraging entrepreneurship.

CO2. Develop skills in providing solutions for

- To start dynamic entrepreneurial ventures and manage them.
- Women entrepreneurship serving as contrivance in societal development

CO3. Develop Critical thinking and evaluation ability.

CO4. Inculcates business acumen and attitude towards trouble shooting

CO5. Design solutions for new start-ups

DETAILED SYLLABUS:

UNIT – I : INTRODUCTION TO ENTREPRENEURSHIP DEVELOPMENT (09 Periods)

Concept of Entrepreneurship – Growth of Entrepreneurship in India **-** Factors affecting entrepreneurship growth - Characteristics of an Entrepreneur – Functions of Entrepreneur – Need for an Entrepreneur – Entrepreneurial Decision Process

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– Types of Entrepreneurs – Distinction between an Entrepreneur and a manager.

UNIT – II : IDEA GENERATION AND FORMULATION OF BUSINESS PLANS   (09 Periods)

Sources of Ideas – Methods of idea generation – Steps in Setting up of a Small Business Enterprise – Formulation of Business Plan – Contents of Business Plan – Significance – Common Errors in Business Plan Formulation – The role of incubation centers for promoting entrepreneurship and start-ups.

UNIT – III : MICRO AND SMALL ENTERPRISES   (09 Periods)

Meaning and Definition – Micro and Macro units – Essentials – Features – Characteristics – Scope of Micro and Small Enterprises – Objectives of Micro Enterprises – relationship between Micro and Macro Enterprises - Problems of Micro and Small Enterprises

UNIT – IV : INSTITUTIONAL FINANCE   (09 Periods)

Institutional Finance **–** Need-Scope-Services - Various Institutions offering Institutional support: – Small Industries Development of Bank of India (SIDBI), State Industrial Development Corporations (SIDCs)– Small Industries Development Organisation (SIDO) – Small Industries Service Institutes (SISIs) – SFCs - National Institute of Entrepreneurship and Small Business Development (NIESBUD) – Micro Units Development and Refinance Agency Bank (MUDRA).

UNIT –V : WOMEN & RURAL ENTREPRENEURSHIP

(09 Periods)

Concept of Women entrepreneur - Functions of Women entrepreneurs - Growth of women entrepreneurship in India - Challenges of Women entrepreneurs- Programmes supporting women entrepreneurship – Rural Entrepreneurship – Meaning, Need for Rural entrepreneurship, Problems of rural entrepreneurship, Role of NGOs, Role of Bharatiya Mahila Bank for encouraging Women Entrepreneurs – Micro Finance & Self Help Groups (Basic Concepts).

TEXT BOOKS:

1. Dr.S.S.Khanka, *Entrepreneurial Development*, S. Chand and Company Ltd, Revised Edition, 2012.

2. Madhurima Lall & Shikha Sahai, *Entrepreneurship*, Excel Books India, 2nd Edition 2008.

REFERENCE BOOKS:

1. Nandan, H., *Fundamentals of Entrepreneurship*, PHI Learning Pvt. Ltd., 2013, New Delhi, 3rd edition 2013.

2. Vasanth Desai, *The Dynamics of Entrepreneurial Development and Management*, Himalaya Publishing House, 4th edition 2009.

3. Bholanath Dutta, *Entrepreneurship Management – Text and Cases*, Excel Books, 1st edition 2009.

III B. Tech. — II Semester
(16BT6HS05) FRENCH LANGUAGE
(La Langue Francais)
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Oral communications; Basic grmmar; advancedgrammar; basic writing; Business French (La Francais Commercial)

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

CO1. Demonstrate knowledge in

    a) Process of communication

    b) Modes of listening

    c) Paralinguistic features

    d) Skimming and Scanning

    e) Elements of style in writing

CO2. Analyze the possibilities and limitations of language, understanding

    a) Barriers to Communication

    b) Barriers to Effective Listening

    c) Barriers to Speaking

    d) Formal and metaphorical language

CO3. Design and develop language skills for professional practice.

CO4. Apply basic writing skills in writing Emails and understanding wide range of technical terminologies.

CO5. Understand French culture and civilization.

CO6. Communicate effectively with the native French in day to day situation.

DETAILED SYLLABUS:

UNIT I –ORAL COMMUNICATION **(09 Periods)**

Introduction - Language as a Tool of Communication, French alphabets, Phonetics and pronunciation, making contacts, giving information, Arranging things, Expression of feelings.

UNIT II –BASIC GRAMMAR **(09 Periods)**

Introduction –Articles, -Er ending Verbs, Nouns, Numbers, Gender, Pronouns, Sentence structure – Case study.

UNIT III –ADVANCED GRAMMAR **(09 Periods)**

Introduction -Adjectives, Prepositions, Introduction to tenses – Present tense, past tense and future tense, Active and Passive voice.

UNIT IV –BASIC WRITING **(09 Periods)**

Introduction -Introduction to written communication, Pre-writing, Creating context for writing and Data collection, fill in forms, Write greeting cards, Invitations and Short personal announcements, Short text to describe photos and pictures.

UNIT V –BUSINESS FRENCH (La Francais Commercial)
(09 Periods)

Introduction - E-mail writing, Letter writing, Learning technical vocabulary and its application.

Case study of influential French companies, Learning computer/desktop/new age- media vocabulary, Introduction to how to present a topic, Fixing an Appointment

Total Periods: 45

TEXT BOOK:

1. Annie Berther, *Alter Ego* , Hachette Publications, 2012

REFERENCE BOOKS:

1. RegineMerieux, *Yves Loiseau*, Connexions, Goyall Publishers, 2011

2. Delphine Ripaud, *Saison*, French and Euroean Inc., 2015

III B. Tech. — II Semester
(16BT6HS06) **GERMAN LANGUAGE**
(Deutsch alsFremdsprache)
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES:—

COURSE DESCRIPTION: Oral communication; Basic grammar; Advanced grammar; Basic writing; Berufsdeutcsch (Business German)

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

CO1. Demonstrate knowledge in

- Process of communication
- Modes of listening
- Paralinguistic features
- Skimming and Scanning
- Elements of style in writing

CO2. Analyze the possibilities and limitations of language, understanding

- Barriers to Communication
- Barriers to Effective Listening
- Barriers to Speaking
- Formal and metaphorical language

CO3. Design and develop language skills for professional practice.

CO4. Apply basic writing skills in writing Emails and understanding wide range of technical terminologies.

CO5. UnderstandGerman culture and civilization.

CO6. Communicate effectively with the native German in day to day situation.

SVEC16 - B.TECH - MECHANICAL ENGINEERING

DETAILED SYLLABUS:

UNIT I –ORAL COMMUNICATION: **(09 Periods)**

Introduction - Language as a Tool of Communication, German alphabets, Phonetics and pronunciation, making contacts, giving information, Arranging things, Expression of feelings.

UNIT II –BASIC GRAMMAR: **(09 Periods)**

Introduction –Articles, Verbs, Nouns, Numbers, Gender, Pronouns, Sentence structure – Case study.

UNIT III –ADVANCED GRAMMAR: **(09 Periods)**

Introduction -Adjectives, Prepositions, Introduction to tenses – Present tense, past tense and future tense, Active and Passive voice, Introduction to Case- Akkusativ, Nominativ, Dativ&Genetiv Case.

UNIT IV –BASIC WRITING: **(09 Periods)**

Introduction -Introduction to written communication, Pre-writing, Creating context for writing and Data collection, fill in forms, Write greeting cards, Invitations and Short personal announcements, Short text to describe photos and pictures.

UNIT V –BERUFSDEUTCSCH (BUSINESS GERMAN):
      (09 Periods)

Introduction - E-mail writing, Letter writing, Learning technical vocabulary and its application.

Case studies of influential German companies, Learning computer/desktop/new age- media vocabulary, Introduction to how to present a topic, Fixing an Appointment.

      Total Periods: 45

TEXT BOOK:

1.   Heuber,*Tangram Aktuelleins*, HeuberVerlagPublications , 2011.

REFERENCE BOOKS:

1.   Anta Kursisa, Gerhard Newner,Sara vicenta, *Fir fuer Deutsch 1 und Deutsch 2***,** HeuberVerlag Publications, 2005

2.   Herman Funk, *Studio D A1*, Cornelsen GOYAL SAAB Publication, 2011.

III B. Tech. – II Semester
(16BT6HS07) **INDIAN CONSTITUTION**
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Elements, functions and functionaries according to Indian Constitution, understanding for better professional practice and good citizenry

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

CO1.   Gain knowledge in

- parliamentary proceedings, laws, legislature, administration and its philosophy
- federal system and judiciary of India
- socials problems and public services like central civil services and state civil services
- Indian and international political aspects and dynamics

CO2.   Develop etiquette and professional behavior in line with the constitution of India for becoming a responsible citizen

DETAILED SYLLABUS:

UNIT - I : PREAMBLE AND ITS PHILOSOPHY   (08 Periods)

Introduction and Evolution of Indian Constitution, preamble and its Philosophy.

UNIT - II : UNION GOVERNMENT   (08 Periods)

Powers, Functions and Position of President, Vice-President and Council of Ministers, Composition of parliament, Constitution Amendment Procedure, Financial Legislation in Parliament.

UNIT - III : FEDERAL SYSTEM   (14 periods)

Centre-State relations, Directive Principles of State Policy, Fundamental Rights and Duties, Centre-State Relations, Features

of Federal System, Administrative Relationship between Union and States, Powers, Functions and Position of Governors, Function of Chief Ministers, Council of Ministers, Composition and powers of the State Legislature.

UNIT - IV : JUDICIARY AND PUBLIC SERVICES

(10 Periods)

The Union Judiciary - Supreme Court and High Court, All India Services, Central Civil Services, State Services, Local Services and Training of Civil Services.

UNIT - V : INTERNATIONAL POLITICS   (05 periods)

Foreign Policy of India, International Institutions like UNO, WTO, SAARC and Environmentalism.

Total periods : 45

TEXT BOOK:

1.   Briji Kishore Sharma, *Introduction to the Constitution of India*, Prentice Hall of India, 2005.

REFERENCE BOOKS:

1.   Mahendra Pal Singh,V. N. Shukla's, *Constitution of India*, Eastern Book Company, 2011.

2.   Pandey J. N., *Constitutional Law of India* - Central Law Agency, 1998

III B. Tech. — II Semester
(16BT6HS08) **INDIAN ECONOMY**
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Introduction; Time Value of Money; Elementary Economic Analysis; Value Analysis; Value Engineering; Economic Planning.

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

CO1. Acquire the knowledge in
- Micro and Macro Economics.
- Traditional and Modern methods of Capital Budgeting.
- Five year plans and NITI Aayog.

CO2. Analyze
- Capital Budgeting.
- Value Analysis and Value Engineering.
- Economic analysis
- Law of supply and demand

CO3. Understand the nuances of project management and finance

DETAILED SYLLABUS:

UNIT — I: INTRODUCTION   (09 Periods)

Economics- Flow in an Economy, Law of Supply and Demand; Micro and Macro Economics; Relationship between Science, Engineering, Technology, and Economic Development; Concept of Engineering Economics-Types of Efficiency, Definition and Scope of Engineering Economics.

UNIT — II: TIME VALUE OF MONEY   (12 Periods)

Concepts and Application; Capital Budgeting-Traditional and Modern Methods; Simple and Compound Interest, Cash Flow Diagram, Principle of Economic Equivalence; Evaluation of Engineering Projects – Present Worth Method, Future Worth

Method, Annual Worth Method, Internal Rate of Return Method, Cost-benefit Analysis in Public Projects; Depreciation Policy- Depreciation of Capital Assets, Causes of Depreciation, Straight Line Method and Declining Balance Method.

UNIT – III: ELEMENTARY ECONOMIC ANALYSIS

(09 Periods)

Economic Analysis – Meaning, Significance, Simple Economic Analysis; Material Selection for a Product, Substitution of Raw Material; Design Selection for a Product; Material Selection- Process Planning, Process Modification.

UNIT - IV: VALUE ENGINEERING   (06 Periods)

Introduction- Value Analysis, Value Engineering,Functions, Aims; Value Analysis vs. Value Engineering; Value Engineering Procedure- Advantages, Application Areas.

UNIT - V: ECONOMIC PLANNING   (09 Periods)

Introduction- Need For Planningin India,Five year plans(1951- 2012), NITI Aayog(from 2014 onwards); Inclusive Growth- Meaning, Significance, Need for inclusive growth in India, Strategy for more inclusive growth, Challenges and Prospects; Employment and Inclusive Growth in India, Role of engineers in sustaining inclusive growth.

Total Periods: 45

TEXT BOOKS:

1. Panneerselvam R., *Engineering Economics*, PHI Learning Private Limited, Delhi , 2/e,2013.

2. Jain T.R., V. K.Ohri, O. P. Khanna, *Economics for Engineers*, VK Publication, 1/e, 2015.

REFERENCE BOOKS:

1. DuttRudar & Sundhram K. P. M, *Indian Economy*,S. Chand, New Delhi, 62 revised edition, 2010.

2. Misra, S.K. & V. K. Puri, *Indian Economy: Its Development Experience*, Himalaya Publishing House, Mumbai   32/e, 2010.

III B. Tech. – II Semester
(16BT6HS09)INDIAN HERITAGE AND CULTURE
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Basic traits of Indian Culture; Humanistic Reforms under Jainism and Buddhism; Culture in the medieval period; Socio Religious reforms in Indian Culture; Reform movements for harmonious relations.

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

CO1. Acquaint knowledge in

- human aspirations and values in Vedic culture.
- cultural aspects of Buddhism and Jainism
- unification of our country under Mourya's and Gupta's administrations
- socio Religious aspects of Indian culture
- reform movements and harmonious relations.

CO2. Apply ethical principles and reforms as models for the upliftment of the societal status in the present cultural contexts

DETAILED SYLLABUS:

UNIT - I: BASIC TRAITS OF INDIAN CULTURE   (09 Periods)

Meaning and definition and various interpretations of culture . Culture and its features. The Vedic and Upanishadic culture and society. Human aspirations and values in these societies. Chaturvidha purushardhas, Chaturashrma and Chaturvarna theory.

UNIT II: HUMANISTIC REFORMS UNDER JAINISM AND BUDDHISM   (09 Periods)

Salient features of Jainism - contributions of Jainism to Indian culture. Contributions of Aachaarya and Mahaapragya. Buddhism

as a humanistic culture. The four noble truths of Buddhism. Contributions of Buddhism to Indian culture.

UNIT - III: CULTURE IN THE MEDIEVAL PERIOD
(09 Periods)

Unifications of India under Mouryas and Guptas and their cultural achievements. Cultural conditions under satavahanas. Contributions to pallavas and cholas to art and cultural achievements of vijayanagara rulers.

UNIT - IV : SOCIO RELIGIOUS REFORMS IN INDIAN CULTURE
(09 Periods)

Western impact on India, Introductin of western education, social and cultural awakening and social reform movements of Rajaramohan Roy - Dayanandha Saraswathi- Anne Besant. (theosophical society)

UNIT - V : REFORM MOVEMENTS FOR HARMONIOUS RELATIONS
(09 Periods)

Vivekananda, Eswarchandra vidyasagar and Veeresalingam- emancipation of women and struggle against caste. Rise of Indian nationalism. Mahatma Gandhi- Non violence and satyagraha and eradication of untouchability

Total Periods: 45

TEXT BOOK:

1. Valluru Prabhakaraiah, *Indian Heritage and Culture*, Neelkamal Publications Pvt. Ltd. Delhi, 1/e , reprint 2015.

REFERENCE BOOKS:

1. L. P. Sharma, *History of Ancient India*, Konark Publishers, Pvt. Ltd. New Delhi, 2010.

2. L. P. Sharma, *History of Medieval India*, Konark Publishers, Pvt. Ltd. New Delhi, 2010.

3. L. P. Sharma, *History of Modern India*, Konark Publishers, Pvt. Ltd. New Delhi, 2010.

4. *The Cultural Heritage of India* Vol-I, II, III, IV, V, The Ramakrishna Mission Institute of Culture, Calcutta.

III B. Tech. — II Semester
(16BT6HS10) **INDIAN HISTORY**
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Introduction; Ancient India; Classical and Medieval era; Modern India; India after independence.

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

CO1. Gain knowledge on evolution and history of India as a nation

CO2. Analyze social and political situations of past and current periods

CO3. Practice in career or at other social institutions morally and ethically

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION   (08 Periods)

Elements of Indian History; History Sources: Archaeology, Numismatics, Epigraphy & Archival research; Methods used in History; History & historiography; sociological concepts-structure, system, organization, social institutions, Culture and social stratification (caste, class, gender, power), State& Civil Society.

UNIT - II : ANCIENT INDIA   (09 Periods)

Mohenjo-Daro civilization; Harappa civilization; Mauryan Empire.

UNIT - III: CLASSICAL & MEDIEVAL ERA   (12 periods)

Classic Era (200 BC - 1200 AD); Hindu - Islamic Era (1200 - 1800 AD).

UNIT - IV: MODERN INDIA **(06 periods)**

Age of Colonialism (17th - 19th centuries); First war of Indian Independence; Freedom Struggle (1857-1947).

UNIT - V: INDIA AFTER INDEPENDENCE (1947 -)

(10 Periods)

The Evolution of the Constitution and Main Provisions; Consolidation of India as a Nation; Politics in the States; Indian economy; Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, Changing Nature of work and organization.

Total periods : 45

TEXT BOOK:

1. K. Krishna Reddy, *Indian History*, Tata McGraw-Hill, 21st reprint,2017

REFERENCE BOOK:

1. Guha, Ramachandra, *India after Gandhi*, Pan Macmillan,2007 Thapar, Romila, *Early India*, Penguin, 2002

III B. Tech. – II Semester

(16BT6HS11) PERSONALITY DEVELOPMENT
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Self-esteem & Self-Management; Developing Positive Attitudes; Self-Motivation & Self-Management; Getting Along with the Supervisor; Workplace Success.

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

CO1. Demonstrate knowledge in
- Self-Management
- Planning Career

CO2. Analyze the situations based on
- Attitudes
- Thinking strategies

CO3. Design and develop the functional skills for professional practice in

CO4. Function effectively as an individual and as a member in diverse teams.

CO5. Communicate effectively in public speaking in formal and informal situations.

DETAILED SYLLABUS:

UNIT – I: SELF-ESTEEM & SELF-IMPROVEMENT

(09 Periods)

Know Yourself – Accept Yourself; Self-Improvement: Plan to Improve - Actively Working to Improve Yourself.

Case study: 1

UNIT – II: DEVELOPING POSITIVE ATTITUDES (09 Periods)

How Attitudes Develop – Attitudes are Catching – Improve Your Attitudes.

Case study: 2

UNIT – III: SELF-MOTIVATION & SELF-MANAGEMENT

(09 Periods)

Show Initiative – Be Responsible Self-Management; Efficient Work Habits – Stress Management – Employers Want People Who can Think – Thinking Strategies.

Case study: 3

UNIT – IV: GETTING ALONG WITH THE SUPERVISOR

(09 Periods)

Know your Supervisor – Communicating with Your Supervisor – Special Communications With Your Supervisor – What Should You Expect of Your Supervisor? – What Your Supervisor Expects   of You - Moving Ahead Getting Along with Your Supervisor.

Case study: 4

UNIT - V: WORKPLACE SUCCESS   **(09 Periods)**

First Day on the Job – Keeping Your Job – Planning Your Career – Moving ahead.

Case study: 5

Total Periods: 45

TEXT BOOK:

1.   Harold R. Wallace and L. Ann Masters, *Personality Development*, Cengage Learning, Delhi, Sixth Indian Reprint 2011.

REFERENCE BOOKS:

1.   Barun K. Mitra, *Personality Development and Soft Skills*, Oxford University Press, New Delhi, 2011.

2.   Stephen R. Covey, *The 7 Habits of Highly Effective People*, Free Press, New York, 1989

3.   K. Alex, *Soft Skills*, S. Chand & Company Ltd, New Delhi, Second Revised Edition 2011.

4.   Stephen P. Robbins and Timothy A. Judge, *Organizational Behaviour*, Prentice Hall, Delhi, 16th Edition 2014.

III B. Tech. – II Semester
(16BT6HS12) PHILOSOPHY OF EDUCATION
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Introduction to Philosophy and Engineering Education; Philosophical methods and their implications in engineering; Philosophical education in India; Values and Engineering education; Outcome based education.

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

CO1. Acquire knowledge in

- Philosophy of Engineering education.
- Philosophical Methods.
- Knowledge acquiring methods.
- Engineering education and responsibilities.

CO2. Understand the impact of Outcome Based Education for effective educational outcomes.

CO3. Apply reasoning to assess societal issues with the contextual knowledge of engineering education and responsibilities.

DETAILED SYLLABUS :

UNIT - I: INTRODUCTION TO PHILOSOPHY AND ENGINNERING EDUCATION   (09 Periods)

Concept , Significance, and Scope of Philosophy in Engineering – Aims of Engineering Education – relationship between philosophy and engineering education – speculative, normative and critical approaches of philosophy in engineering.

UNIT - II: PHILOSOPHICAL METHODS AND THEIR IMPLICATIONS IN ENGINEERING   (09 Periods)

Introduction to Philosophical approaches: Idealism, Naturalism, Pragmatism, Realism and Existentialism; Significance and Scope in Engineering Education.

UNIT - III: PHILOSOPHICAL EDUCATION IN INDIA
(09 Periods)

Different branches of philosophy- meaning, Epistemology: nature and scope; Knowledge acquiring methods; Kinds and instruments of knowledge; Re-shapingof educational thoughts by Indian thinkers: Rabindranath Tagore, Sri Aurobindo Gosh, Mahatma Gandhi,Jiddu Krishnamurthy and Swamy Vivekananda.

UNIT - IV: VALUES AND ENGINEERING EDUCATION
(09 Periods)

Introduction; Engineering educationand responsibilities: health,social, moral, ethics aesthetic;Value: crisis and strategies forinculcation;

Case study: Engineering Solutions given by Mokshagundam Visvesvaraya

UNIT - V: OUTCOME - BASED EDUCATION   (09 Periods)

Institutional visioning ;educational objectives ; programme outcomes , curriculum, stakeholders, infrastructure and learning resources ; governance and management, quality in education.

Total periods: 45

TEXT BOOKS:

1. Ganta Ramesh, *Philosophical Foundations of Education*, Neelkamal Publications, 1/e,2013

2. CarlMicham,*Thinking through technology*(The Paths between Engineering and Philosophy).University of Chicago Press, 1/e,1994.

3. Louis L Bucciarelli, *Engineering Philosophy*,Delft University Press,1/e, 2003.

4. NBA/ABET Manuals.

REFERENCE BOOKS :

1. Louis L Bucciarelli, *Philosophy of Technology and Engineering Sciences*, North Holland, 1/e, 2009(e-book).

2. Samuel Florman, *Existential pleasures of education,* Martins's Griffin S.T. publication, 1/e 1992.

III B. Tech. – II Semester
(16BT6HS13) PUBLIC ADMINISTRATION
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Introduction; Public Policy; Good Governance; E-Governance; Development Administration.

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

CO1. Acquire knowledge in

- Public Policy.
- Good Governance.
- E-governance.
- Development Administration.

CO2. Analyze the possibilities and limitations of existing policies through Good Governance perspective.

CO3. Design and develop solutions in e-governance models to find and provide opportunities in e-governance.

CO4. Adopt principles of e-governance in addressing the existing issues and challenges in e-governance sector.

CO5. Understand the significance of Administrative Development in finding professional engineering solutions by probing Bureaucracy. Role of civil society.

DETAILED SYLLABUS:

UNIT – I: INTRODUCTION   (09 Periods)

Public and Private Administration- Differences and Similarities, Meaning, Scope; Importance of Public Administration in Modern Era; Public Administration and its implications in the field of Engineering.

Case Study: Unique Identification Authority of India (UIDAI):Aadhaar Project: Challenges Ahead

UNIT – II: PUBLIC POLICY   (09 Periods)

Meaning and Scope; Policy Formulation in India; Policy making process; Policy Implementation

Engineering and Public Policy,Social, ethical, Monetary and fiscal policies; policy implications of engineering; The engineer's role in Public Policy.

Case Study:NITI Aayog: Demonetization and Aftermath of Demonetization – Cashless transactions.

UNIT – III: GOOD GOVERNANCE   (09 Periods)

Significance; Objectives; Concepts; Reforms; Organization and its basic problems Administrative and Governance reforms in India; Sustainable and Inclusive growth in India; Engineering and Sustainable Environment-Role of Engineers; Right to information Act

Case Study: Strategies in Good Governance: A Case Study of Karnataka, Kerala and Orissa.

UNIT – IV: E-GOVERNANCE   (09 Periods)

Meaning, Significance, Issues in E-governance; E-governance Models, Problems and Opportunities; Application of DataWarehousing and Data Mining in Governance; Engineers role in re-engineering E-governance.

Case Study: e-Housing System for Bhavana Nirman Dhanasahayam Online disbursement of housing assistance in Kerala.

UNIT-V: DEVELOPMENT ADMINISTRATION   (09 Periods)

Introduction; Development Administration-Administrative Development- Sustainable Development -Significance-Objectives; Bureaucracy - Personnel administration and human resources development; Role of civil society-Citizens and administration; Development and Engineering: Issues Challenges and Opportunities.

Case Study: Neeru-Chettu (Water-Tree) of Andhra Pradesh.

Case Study: TPDDL of Delhi and Odisha.

Total Periods: 45

TEXT BOOKS:

1. M.P. Sharma, B.L. Sadana, HarpreetKaur, *Public Administration in Theory and Practice*, KitabMahal, Mumbai, 1/e,2014.

2. CSR Prabhu, *E. Governance – concepts and case studies*, PHI, New Delhi,2/e 2012.

REFERENCE BOOKS:

1. SurendraMunshi, Bijupaul Abraham, *Good Governance, Democratic societies and Globalization*, Sage publications, New Delhi,1/e ,2004.

2. R.K.Sapru, *Public Policy*,Sterling Publishers Pvt Ltd., New Delhi, 1/e, 2001.

III B. Tech. – II Semester
(16BT60112) BUILDING MAINTENANCE AND REPAIR
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Durability of buildings, Failure and repair of buildings, MaterialTechniques for repair, Maintenance of buildings, Conservation and recycling.

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

CO1. Acquire basic knowledge on durability and serviceability, failures, repair and rehabilitation of buildings.

CO2. Analyze failures, repair and rehabilitation techniques.

CO3. Solve complex building maintenance problems through proper investigations and interpretation.

CO4. Use modern tools and techniques for various repairs and rehabilitation of structures.

CO5. Provide solutions for building maintenance and repair problems considering health and safety.

CO6. Consider environmental sustainability in building maintenance and repair.

CO7. Maintain ethical standards for quality in repairs and rehabilitation of structures.

CO8. Evaluate specifications and perform cost analysis of building components while repair and rehabilitation.

DETAILED SYLLABUS:

UNIT – I: DURABILITY AND SERVICEABILITY OF BUILDINGS (10 Periods)

Life expectancy of different types of buildings; Effect of environmental elements such as heat, dampness, frost and precipitation on buildings; Effect of chemical agents on building

materials, Effect of pollution on buildings, Effect of fire on building; Damage by biological agents like plants, trees, algae, fungus, moss, insects, etc.; Preventive measures on various aspects, Inspection, Assessment procedure for evaluating for damaged structures, Causes of deterioration, Testing techniques.

UNIT – II: FAILURE AND REPAIR OF BUILDINGS

(10 Periods)

Building failure – Types, Methodology for investigation; Diagnostic testing methods and equipment, Repair of cracks in concrete and masonry, Materials for Repair, Methods of repair, Repair and strengthening of concrete buildings, Foundation repair and strengthening, Underpinning, Leakage of roofs and repair methods.

UNIT – III: TECHNIQUES FOR REPAIR (08 Periods)

Rust eliminators and polymers coating for rebars during repair, Foamed concrete, Mortar and dry pack, Vacuum concrete, Gunite and shotcrete, Epoxy injection, Mortar repairs for cracks, Shoring and underpinning.

UNIT – IV: MAINTENANCE OF BUILDINGS (09 Periods)

Reliability principles and its applications in selection of systems for building, Routine maintenance of building, Maintenance cost, Specifications for maintenance works, Dampness - Damp proof courses, Construction details for prevention of dampness; Termite proofing, Fire protection, Corrosion protection.

UNIT – V: CONSERVATION AND RECYCLING (08 Periods)

Performance of construction materials and components in service, Rehabilitation of constructed facilities, Conservation movement, Materials and methods for conservation work, Recycling of old buildings and its advantages, Examples.

Total Periods: 45

TEXT BOOKS:

1. Dennison Campbell, Allen and Harold Roper, *Concrete Structures – Materials, Maintenance and Repair*, Longman Scientific and Technical, UK, 1991.

2. Allen, R. T. L., Edwards, S. C. and J. D. N. Shaw, *The Repair of Concrete Structures*, Blackie Academic & Professional, UK, 1993.

REFERENCE BOOKS:

1. Peter H. Emmons, *Concrete Repair and Maintenance*, John Wiley and Sons Publications, 2002.

2. *Building Construction under Seismic Conditions in the Balkan Region*, UNDP/UNIDO Project Rer/79/015, Volume 5, Repair and Strengthening of Reinforced Concrete, Stone and Brick Masonry Buildings, United Nations Industrial Development Organisation, Vienna.

3. Shetty, M. S., *Concrete Technology*, S. Chand and Company.

4. Smith, P. and Julian, W., *Building Services*, Applied Science Publications, London, 1976.

5. SP: 25, BIS; Causes and Prevention of Cracks in Buildings.

6. Champion, S., *Failure and Repair of Concrete Structures*, John Wiley and Sons Publications, 1961.

Perkins, P. H., Repair, *Protection and Water Proofing of Concrete Structures*, E& FN Spon, UK, 3rd Edition, 1997.

III B.Tech. — II Semester
(16BT60113) CONTRACT LAWS AND REGULATIONS
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Construction contracts; Tenders; Arbitration; Legal requirements; Labour regulations.

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

CO1. Demonstrate basic Knowledge on construction contracts, tenders, arbitration, legal requirements and labour regulations.

CO2. Analyze contracts and tenders.

CO3. Address the legal issues in contracts and tenders.

CO4. Follow laws and regulations in the preparation of contracts and tenders.

CO5. Prepare contract and tender documents as per the standards.

CO6. Consider project schedule, cost, quality and risk in the preparation of contracts and tenders.

DETAILED SYLLABUS:

UNIT—I: CONSTRUCTION CONTRACTS   (09 Periods)

Indian contracts act, Elements of contracts, Types of contracts, Features, Suitability, Design of contract documents, International contract document and laws, Standard contract document, Law of torts.

UNIT—II: TENDERS   (09 Periods)

Prequalification, Bidding, Accepting; Evaluation of tender from technical, contractual and financial points of view; Two cover system, Preparation of the documentation, Contract formation and interpretation, Potential contractual problems, Price

variation clause, Comparison of actions and laws, Subject matter, Violations.

UNIT—III: ARBITRATION   (09 Periods)

Arbitration, Comparison of actions and laws, Agreements, Appointment of arbitrators, Conditions of arbitration, Powers and duties of arbitrator, Rules of evidence, Enforcement of award, Arbitration disputes, Dispute review board.

UNIT — IV: LEGAL REQUIREMENTS   (09 Periods)

Legal requirements for planning, Property law, Agency law, Tax laws – Income tax, Sales tax, Excise and custom duties, Local government approval, Statutory regulations, Insurance and bonding, Laws governing purchase and sale, Use of urban and rural land, Land revenue codes, EMD, Security deposits, Liquidated damages.

UNIT — V: LABOUR REGULATIONS   (09 Periods)

Social security, Welfare legislation; Laws relating to wages, bonus and industrial disputes; Labour administration, Insurance and safety regulations, Workmen's compensation act, Maternity benefit act, Child labour act, Other labour laws.

Total Periods: 45

TEXT BOOKS:

1. Subba Rao, G. C. V., *Law of Contracts I & II, S. Gogia & Co.*, 11th Edition, 2011.

2. Jimmie Hinze, *Construction Contracts*, McGraw Hill, 3nd Edition, 2011.

REFERENCE BOOKS:

1. Kishore Gajaria, GT Gajaria's, *Law Relating to Building and Engineering Contracts in India*, Lexis Nexis Butterworths India, 4th Edition, 2000.

2. Patil, B. S., *Civil Engineering Contracts and Estimates*, University Press (India) Private Ltd., 4th Edition, 2015.

3. Joseph T. Bockrath, *Contracts and the Legal Environment for Engineers and Architects*, McGraw Hill Education, 7th Edition, 2010.

   Akhileshwar Pathak, *Contract Law*, Oxford University Press, 2011.

III B.Tech. - II Semester
(16BT60114) DISASTER MITIGATION AND MANAGEMENT
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Disasters; Earthquakes; Floods; Cyclones; Droughts; Landslides; Disaster management.

COURSE OUTCOMES: On successful completion of course, students will be able to:

CO1. Demonstrate knowledge on disasters, their vulnerability and mitigation measures.

CO2. Analyze disasters and their vulnerability.

CO3. Design strategies for effective disaster mitigation.

CO4. Address pre and post disaster issues for better preparedness and mitigation measures, through proper analysis and interpretation.

CO5. Use appropriate methods in disaster mitigation and management.

CO6. Use historical data of disasters to inform the people over preparedness and mitigation measures.

CO7. Solve disaster related issues considering environment.

CO8. Consider economical issues in disaster management.

DETAILED SYLLABUS:

UNIT-I: DISASTERS   **(09 Periods)**

Types of disasters - Natural disasters; Impact of disasters on environment, infrastructure and development; Concepts of hazards and vulnerability analysis, Hazard Assessment, Guidelines for hazard assessment and vulnerability analysis, Basic principles and elements of disaster mitigation.

UNIT- II: EARTHQUAKES   (09 Periods)

Introduction to earthquake, Intensity scale (MSK–64), Seismic activity in India, Seismic zones of India, Earthquakes in A.P., Action plan for earthquake disaster preparedness, Elements at risk, Recovery and rehabilitation after earthquake, Earthquake resistant design and construction of buildings; Tsunami – Onset, Types and causes, Warning, Elements at risk, Typical effects, Specific preparedness and mitigation strategies.

UNIT- III: FLOODS, CYCLONES AND DROUGHTS

(11 Periods)

Floods and Cyclones: Onset, Types, Warnings; Elements at risk, Typical effects, Indian floods and cyclones, Hazard zones, Potential for reducing hazards, Mitigation strategies and community based mitigation.

Droughts: Onset, Types and warning; Causes, Impact, Early warning and response mechanisms, Mitigation strategies, Droughts in India.

UNIT- IV: LANDSLIDES   (08 Periods)

Onset, Types and warning; Causes, Elements at risk, Indian landslides, Hazards zones, Typical effects, Mitigation strategies and community based mitigation.

UNIT- V: DISASTER MANAGEMENT   (08 Periods)

Disaster management organization and methodology, Disaster management cycle, Disaster management in India – Typical cases; Cost–benefit analysis with respect to various disaster management programs implemented by NGOs and Government of India.

Total Periods: 45

TEXT BOOKS:

1. V. K. Sharma, *Disaster Management*, Medtech Publishing, 2nd Edition, 2013.

2. Anand S. Arya, Anup Karanth, and Ankush Agarwal, Hazards, *Disasters and Your Community: A Primer for Parliamentarians, GOI–UNDP Disaster Risk Management Programme, Government of India, National Disaster Management Division, Ministry of Home Affairs*, New Delhi, Version 1.0, 2005.

REFERENCE BOOKS:

1. Donald Hyndman and David Hyndman, *Natural Hazards and Disasters*, Cengage Learning, 3rd Edition, 2011.

2. *Disaster Management in India, A Status Report, Ministry of Home Affairs, Govt. of India*, May 2011.

3. Rajendra Kumar Bhandari, *Disaster Education and Management: A Joyride for Students, Teachers, and Disaster Managers*, Springer India, 2014.

4. R. B. Singh, *Natural Hazards and Disaster Management*, Rawat Publications, 2009.

III B.Tech. - II Semester
(16BT60115) ENVIRONMENTAL POLLUTION AND CONTROL
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES:

COURSE DESCRIPTION: Fundamentals of air pollution; Dispersion of pollutants; Effects and control of air pollution; Water pollution; Soil pollution and control; Municipal solid waste management.ement.

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

CO1. Demonstrate knowledge on air, water, soil pollution and their control and solid waste management.

CO2. Analyze causes and effects of air, water and soil pollution and their remedial measures.

CO3. Recommend suitable solutions to complex environmental pollution problems.

CO4. Use appropriate remedial technique to solve environmental pollution problems.

CO5. Understand the effects of environmental pollution on human health and vegetation.

DETAILED SYLLABUS:

UNIT – I: AIR AND NOISE POLLUTION   (08 Periods)

Air Pollution: Scope, Significance, Classification, Sources – Line, Area, Stationary, Mobile; Effects of air pollutants on man, material and vegetation; Global effects of air pollution; Air pollution meteorology - Lapse rate, Inversion, Plume pattern; Dispersion of air pollutants - Dispersion models and applications; Ambient air quality standards.

Noise Pollution: Sound pressure, Power and intensity, Impacts of noise, permissible limits of noise pollution, measurement of noise.

UNIT – II: AIR AND NOISE POLLUTION CONTROL
(10 Periods)

Self cleansing properties of the environment, Dilution method, Control at source, Process changes and equipment modifications, Control of particulates – Types of equipment, Design and operation - Settling chambers, Centrifugal separators, Bag house filters, Wet scrubbers, Electrostatic precipitators; Control of gaseous pollutants – Adsorption, Absorption, Condensation, Combustion; Control of air pollution from automobiles, Control of noise pollution.

UNIT – III: WATER POLLUTION AND CONTROL (10 Periods)

Water pollution – Sources, Causes, Effects; Surface and groundwater quality – Physical, Chemical, Biological; Drinking water quality standards, Water purification – Processes, Engineered systems – Aeration, Solids separation, Settling operations, Coagulation, Softening, Filtration, Disinfection; Wastewater – Sources, Causes, Effects, Treatment and disposal – Primary, Secondary, Tertiary; Case studies.

UNIT – IV: SOIL POLLUTION AND CONTROL   (08 Periods)

Soil pollutants, Sources of soil pollution, Causes, Effects and control of soil pollution, Diseases caused by soil pollution, Methods to minimize soil pollution, Effective measures to control soil pollution, Case studies.

UNIT – V: MUNICIPAL SOLID WASTE MANAGEMENT
(09 Periods)

Types of solid waste, Composition of solid waste, Collection and transportation of solid waste, Methods of disposal – Open dumping, Sanitary landfill, Composting, Incineration, Utilization - Recovery and recycling, Energy Recovery.

Total Periods: 45

TEXT BOOKS:

1. Peavy, H. S, Rowe, D. R., and Tchobanoglous, G., *Environmental Engineering*, McGraw Hill Inc., 1985.

2. C. S. Rao, *Environmental Pollution Control Engineering*, New Age International Pvt. Ltd., 2nd Edition, 2007.

3. Ibrahim A. Mirsa, *Soil Pollution: Origin, Monitoring & Remediation*, Springer, UK, 2nd Edition, 2008.

REFERENCE BOOKS:

1. M. N. Rao and H. V. N. Rao, *Air Pollution*, Tata McGraw–Hill Education Pvt. Ltd., 19th Edition, 2010.

2. Daniel Vallero, *Fundamentals of Air Pollution*, Academic Press (Elsevier), 5th Edition, 2014.

3. S. M. Khopkar, *Environmental Pollution Monitoring and Control*, New Age International Pvt. Ltd., 2nd Edition, 2007.

4. V. M. Domkundwar, *Environmental Engineering*, Dhanpat Rai & Co. Pvt. Ltd., New Delhi, 2014.

(16BT60116) **PLANNING FOR SUSTAINABLE DEVELOPMENT**
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES:—

COURSE DESCRIPTION: Sustainable development; Environmental impact; Sustainable Policies; Governance; Theories and strategies; Media and education for sustainability.

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

CO1. Demonstrate the knowledge on sustainable development, environmental impact, sustainable policies, governance, systems and strategies, media and education for sustainability.

CO2. Analyze theories, environmental impact, policies, systems and strategies for sustainable development.

CO3. Develop suitable methods and systems for sustainable development.

CO4. Use appropriate techniques in solving issues related to sustainable development.

CO5. Provide solutions to problems associated with sustainable development considering society.

CO6. Consider environment while planning sustainable development.

CO7. Communicate effectively on sustainable development issues through media and education.

CO8. Consider economical issues while planning for sustainable development.

DETAILED SYLLABUS:

UNIT – I: SUSTAINABLE DEVELOPMENT   (09 Periods)

Definition and concepts of sustainable development, Capitalization of sustainability - National and global context; Millennium development goals, Emergence and evolution of sustainability and sustainable development, Theories of sustainability, Case studies.

UNIT – II: ENVIRONMENTAL IMPACT   (09 Periods)

Climate change – Science, Knowledge and sustainability; Unforeseen environmental impacts on development, Challenges of sustainable development, Centrality of resources in sustainable development, Case studies.

UNIT – III: SUSTAINABLE POLICIES AND GOVERNANCE
(09 Periods)

Governance - Democracy and Eco–welfare; Global civil society and world civil politics, Civic environmentalism, Policy responses to sustainable development, Economics of sustainability, Social responsibility in sustainability, National action, ISO 14001: Environmental management system.

UNIT – IV: SUSTAINABLE SYSTEMS AND STRATAGIES
(09 Periods)

Need for system innovation, Transition and co–evolution, Theories and methods for sustainable development, Strategies for eco–innovation, Ecological foot print analysis, Socio ecological indicators – Eco labels; Policy programmes for system innovation, Case studies.

UNIT – V: MEDIA AND EDUCATION FOR SUSTAINABILITY
(09 Periods)

Role of emerging media, Remarkable design and communication art, Activism and the public interest, Education for sustainability, Participation in decision making, Critical thinking and reflection, Case studies.

Total Periods: 45

TEXT BOOKS:

1. John Blewitt, *Understanding Sustainable Development*, Earth Scan Publications Ltd., 2nd Edition, 2008.

2. Jennifer A. Elliot, *An Introduction to Sustainable Development*, Earth Scan Publications Ltd., 4th Edition, 2006.

REFERENCE BOOKS:

1. Peter Rogers, Kazi F Jalal and John A Boyd, *An Introduction to Sustainable Development*, Earth Scan Publications Ltd., 2006.

2. Simon Dresner, *The Principles of Sustainability*, Earth Scan Publications Ltd., 2nd Edition, 2008.

3. Peter Bartelmus, *Environment Growth and Development: The Concepts and Strategies of Sustainability*, Routledge, 3rd Edition, 2003.

4. Gabriel Moser, Enric Pol, Yvonne Bernard, Mirilia Bonnes, Jose Antonio Corraliza and Maria Vittoria Giuliani, *People Places and Sustainability*, Hogrefe & Huber Publishers, 2nd Edition, 2003.

III B.Tech. – II Semester
(16BT60117) PROFESSIONAL ETHICS
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: --

COURSE DESCRIPTION: Engineering ethics; Professional ideals and virtues; Engineering as social experimentation; Responsibilities and rights; Global issues.

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

CO1. Demonstrate the principles of ethics, importance of professional values and social responsibility.

CO2. Analyze the problems in the implementation of moral autonomy and use ethical theories in resolving moral dilemmas.

CO3. Develop suitable strategies to resolve problems arise in practicing professional ethics.

CO4. Provide solutions to complex problems associated with professional ethics by proper analysis and interpretation.

CO5. Use appropriate theories in resolving issues pertain to professional ethics.

CO6. Understand the impact of professional ethics on society and address the limitations of codes of ethics.

CO7. Practice engineering with professionalism, accountability and ethics.

CO8. Function as a member, consultant, manager, advisor and leader in multi-disciplinary teams.

CO9. Write reports without bias and give instructions to follow ethics.

DETAILED SYLLABUS:

UNIT - I: ENGINEERING ETHICS   (09 periods)

Scope and aim of engineering ethics, Senses of engineering ethics, Variety of moral issues, Types of inquiry, Moral dilemmas,

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Moral autonomy-Kohlberg's theory, Gilligan's theory, Consensus and controversy.

UNIT - II: PROFESSIONAL IDEALS AND VIRTUES
(08 periods)

Theories about virtues, Professions, Professionalism, Characteristics, Expectations, Professional responsibility, Integrity, Self-respect, Sense of responsibility, Self-interest, Customs and religion, Self-interest and ethical egoism, Customs and ethical relativism, Religion and divine command ethics, Use of ethical theories, Resolving moral dilemmas and moral leadership.

UNIT - III: ENGINEERING AS SOCIAL EXPERIMENTATION
(10 periods)

Engineering as experimentation, Similarities to standard experiments, Learning from the past and knowledge gained, Engineers as responsible experimenters, Conscientiousness, Moral autonomy and accountability, The challenger case, Codes of ethics and limitations, Industrial standards, Problems with the law of engineering.

UNIT - IV: RESPONSIBILITIES AND RIGHTS **(09 periods)**

Collegiality and loyalty, Respect for authority, Collective bargaining, Confidentiality, Conflict of interests, Occupational crime, Rights of engineers, Professional rights, Whistle-blowing, The BART case, Employee rights and discrimination.

UNIT - V: GLOBAL ISSUES **(09 periods)**

Multinational corporations, Professional ethics, Environmental ethics, Computer ethics, Engineers as consultants, Witnesses, Advisors and Leaders, Engineers as Managers, Managerial ethics applied to Engineering Profession, moral leadership.

Total Periods: 45

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, *Ethics in Engineering*, Tata McGraw-Hill, 3rd Edition, 2007.

2. Govindarajan, M., Nata Govindarajan, M., Natarajan, S. and Senthilkumar, V. S., *Engineering Ethics*, Prentice Hall of India, 2004.

REFERENCE BOOKS:

1. S. Kannan and K. Srilakshmi, *Human Values and Professional Ethics*, Taxmann Allied Services Pvt Ltd., 2009.

2. Edmund G. Seebauer and Robert L. Barry, *Fundamental of Ethics for Scientists and Engineers*, Oxford University Press, 2001.

3. Charles F. Fledderman, *Engineering Ethics*, Pearson Education, 2nd Edition, 2004.

4. R. Subramanaian, *Professional Ethics*, Oxford Higher Education, 2013.

III B.Tech. - II Semester

(16BT60118) **RURAL TECHNOLOGY**

(Common to CE, ME, CSE, IT & CSSE)

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Rural technology; Non conventional energy; Community development; IT in rural development.

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

CO1. Demonstrate the knowledge on technologies for rural development.

CO2. Analyze various technologies available which are appropriate for rural development.

CO3. Carryout feasibility study on the public and private partnership for rural development.

CO4. Develop and use latest technologies for rural development.

CO5. Address health and safety issues while choosing technologies for rural development.

CO6. Educate the rural populace on the positive impacts of biofertilisers and usage of agromachinery in agriculture.

DETAILED SYLLABUS:

UNIT – I: RURAL TECHNOLOGY   (09 Periods)

India - Technology and rural development, Pre and post independence period, Rural India Life, Indian farmer, Role of science and technology in rural development, Rural technology and poverty eradication, Rural business hubs, Technology in improving rural infrastructure, Various organizations related to innovation, Issues of technology transfer - CAPART, NABARD, CSIR, NIF.

UNIT – II: NON CONVENTIONAL ENERGY   (09 Periods)

Definition of energy, Types of alternative sources of energy, Sources of non conventional energy – Solar energy: Solar cooker,

Solar heater; Biogas, Recycling and management, Wastes conservation, Assessment and production of biomass products and their utilization.

UNIT – III: TECHNOLOGIES FOR RURAL DEVELOPMENT
(09 Periods)

Food and agro based technologies, Tissue culture, Nursery, Building and construction technologies, Cultivation and processing of economic plants, Cottage and social industries.

UNIT – IV: COMMUNITY DEVELOPMENT   (09 Periods)

Water conservation, Rain water Harvesting, Drinking water, Environment and Sanitation, Bio fertilizers, Medical and aromatic plants, Employment generating technologies – Apiculture, Pisciculture, Aquaculture.

UNIT – V: IT IN RURAL DEVELOPMENT   (09 Periods)

Role of information technology (IT) in rural areas, Impact of IT in rural development, Need and necessity of technology, Corporate social responsibilities, Private sector participation (Activities in different spheres: Employment, Education, Health, Agriculture and service sectors) and Saansad Adarsh Gram Yojana (SAGY), Village adoption schemes.

Total Periods: 45

TEXT BOOKS:

1. M. S. Virdi, *Sustainable Rural Technologies*, Daya Publishing House, 2009.

2. S. V. Prabhath and P. Ch. Sita Devi, *Technology and Rural India*, Serials Publications, 2012.

REFERENCE BOOKS

1. R. Chakravarthy and P. R. S. Murthy, *Information Technology and Rural Development*, Pacific Book International, 2012.

2. Shivakanth Singh, *Rural Development Policies and Programmes*, Northern Book Centre, 2002.

3. L. M. Prasad, *Principles and Practice of Management*, S. Chand & Sons, 8th Edition, 2014.

4. Venkata Reddy, K., *Agriculture and Rural Development - Gandhian Perspective*, Himalaya Publishing House, 2001.

III B.Tech. - II Semester
(16BT60308) GLOBAL STRATEGY AND TECHNOLOGY

(Common to CE, ME, CSE, IT & CSSE)

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES:—

COURSE DESCRIPTION: Introduction to strategic management; Strategic management process; Principles of good strategy; Globalization strategies; Research and Development strategies; Technology Management and Transfer; Elements of Transfer Process; Corporate Governance in the Indian scenario.

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

CO1.   Demonstrate the knowledge on Strategic management, Research & development strategies, Technology management and transfer, Globalization and Corporate governance.

CO2.   Indentify and analyze crucial problems in strategic management to improve performance of the organizations.

CO3.   Develop the products and production process by using research and development strategies.

CO4.   Conduct investigations on the impact of globalization in current scenario in the context of corporate governance.

CO5.   Appraise the resources and capabilities of the firm in terms of their ability to confer sustainable development.

CO6.   Apply ethics in strategic decision making.

DETAILED SYLLABUS:

UNIT - I: STRATEGIC MANAGEMENT   **(09 Periods)**

Introduction, Classes of decisions, Levels of strategy, Core competence, Strategic intent and stretch, Approaches to strategy making, Roles of different strategists, Strategic

management- Process, Benefits, Limitations; Ethics in strategic decision making, Principles of good strategy, Strategic Management in India.

UNIT - II: RESEARCH & DEVELOPMENT STRATEGIES

(09 Periods)

Concept, Evolution of R&D Management, R&D as a business, R&D as competitive advantage, Elements of R & D strategies, Integration of R & D, Selection and implementation of R & D strategies, R & D trends.

UNIT - III: TECHNOLOGY MANAGEMENT AND TRANSFER

(09 Periods)

Technology Management: Introduction, Technology - Definition, Components, Classification Features; Technology Management- Concept, Nature; Drivers of Management of Technology-Significance, Scope, Responding to technology challenges.

Technology Transfer: Introduction, Definition, Classification, Significance, Elements of process, Types of Technology Transfer, Package, Modes of Transfer, Routes, Channels and Effectiveness of   Technology Transfer.

UNIT - IV: GLOBALISATION   (09 Periods)

Definition, Stages, Essential conditions for globalization, Globalization strategies, Competitive advantage of Nations, Factors affecting Globalization, Globalization of Indian business.

UNIT – V: CORPORATE GOVERNANCE: THE INDIAN SCENARIO   (09 Periods)

Emergence of corporate governance in India- Landmarks, Models, Codes and status in India, Role and Responsibilities of Regulators, The Board of Directors; Corporate Governance-Specific issues in India, Family owned Business, Corporate Governance and the Indian ethos.

Total periods: 45

TEXT BOOKS:

1. Francis Cherunilam, *Strategic Management*, Himalaya Publishing House, 3rd Edition, 2002.

2. C.S.G.Krishnamacharyulu and Lalitha Ramakrishnan, *Management of Technology*, Himalaya Publishing House, Second Edition, 2012.

REFERENCE BOOKS:

1. White and Bruton, *The Management of Technology and Innovation: A Strategic Approach*, Cengage Learning, 1st Edition, 2007.

2. S.K.Mandak, *Ethics in Business and Corporate Governance*, TMH, 2nd Edition, 2012.

III B.Tech. - II Semester
(16BT60309) INTELLECTUAL PROPERTY RIGHTS AND MANAGEMENT

(Common to CE, ME, CSE, IT & CSSE)

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Protection of ideas; innovation and artistic endeavors; Acts and procedure related to patents, trademarks, copy right, design registration, trade secrets and cyber laws; Infringement; Commercialization of intellectual property rights; Case studies in each.

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

CO1. Demonstrate knowledge on intellectual property rights, patents, trademarks, copyrights, trade secrets and commercialization of intellectual property.

CO2. Analyse the commercial significance of discoveries and developments and to assist in bringing these into public use.

CO3. Investigate and ensure smooth transition from concept to final product by following National & International Laws of Intellectual Property.

CO4. Utilize the various policies and procedures related to patents, trademarks and copyrights relating to IPR.

CO5. Safeguard, review and manage the intellectual property so that it may receive adequate and appropriate legal protection against unauthorized use.

CO6. Follow ethical standards in capacity building and work as a platform for development, promotion, protection, compliance, and enforcement of intellectual property and knowledge.

CO7. Prepare documents and fill applications needed for filing a patent, design, copyright and trade mark.

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DETAILED SYLLABUS:

UNIT – I: OVERVIEW OF INTELLECTUAL PROPERTY RIGHTS
(09 Periods)

Introduction, Intellectual Property vs Conventional Property, and importance of intellectual property rights (IPRs), types of intellectual property, International Treaties for protection of IPR-Paris Convention, World Intellectual Property Organization (WIPO), World Trade Organization (WTO), Trade Related Aspects of Intellectual Property Rights (TRIP) Agreement, General Agreement on Tariffs and Trade(GATT).

UNIT – II: TRADEMARKS **(09 Periods)**

Introduction, Functions and kinds of trademarks, Trade Mark Registration Process, Post registration procedures, Trade Mark maintenance, Transfer of rights, Inter parties Proceedings, Infringement and Dilution of Ownership of Trade Mark, Trade Mark claims, International Trade Mark Law.

UNIT – III: PATENTS **(09 Periods)**

Introduction, Rights under Patent Law, Patent Application Process, Terms and Maintenance of Patents Requirements, Patent Ownership and Transfer, Licensing of Patent Rights, Sole and Joint Inventors, Disputes over Inventorship, Patent Infringement, International Patent Law, Patent Cooperation Treaty (PCT), Patent Law Treaty (PLT), Substantive Patent Law Treaty (SPLT).

UNIT - IV: COPY RIGHTS, TRADE SECRETS, CYBER LAWS
(09 Periods)

Copy Rights: Introduction, nature and scope, subject matter, Rights afforded by copyright law, Copyrights ownership, transfers and duration, Copyright registration process.

Trade Secrets: Introduction, Determination of Trade Secret Status, Emploer-Employee Relationships, Protection of submissions.

Cyber laws: E-commerce and cyber laws, cyber crime and legislation- need, objective and scope; IT Act 2000, Information Technology and Information Security.

UNIT - V: INDUSTRIAL DESIGN AND COMMERCIALIZATION OF INTELLECTUAL PROPERTY RIGHTS   **(09 Periods)**

Industrial Design: Intoduction, Indian Law related to registration of Industrial Designs, Essential requirements for registration of a design in India, International Agreements – Hague System; Conflicts related to registration of design.

Commercialization of Intellectual Property Rights: Competition and Confidentiality Issues, Antitrust Laws, Assignment of Intellectual Property Rights, Technology, Transfer Agreements, Intellectual Property Issues in the Sale of Business, Legal Auditing of Intellectual Property, Due diligence of Intellectual Property Rights in a Corporate Transaction.

Total Periods: 45

TEXT BOOKS:

1. Deborah E. Bouchoux, *Intellectual Property: The Law of Trademarks*, Copyrights, Patents and Trade Secrets, Cengage Learning, 4th edition, 2016.

2. Kompal Bansal and Parikshit Bansal, *Fundamentals of Intellectual Property for Engineers*, BS Publications, 1st Edition, 2013.

REFERENCE BOOKS:

1. Prabuddha Ganguli, *Intellectual Property Rights-Unleashing the Knowledge Economy*, McGraw Hill Education, 6th reprint, 2015.

2. P. Narayanan, *Intellectual Property Law, Eastern Book Company*, 3rd Edition, 2013.

3. R. Radha Krishnan, S. Balasubramanian, *Intellectual Property Rights: Text and Cases*, Excel Books, 1st Edition, 2008.

III B. Tech. – II Semester
(16BT60310) MANAGING INNOVATION AND ENTREPRENEURSHIP

(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Evolution of entrepreneurship from economic theory Managerial and entrepreneurial competencies; Concepts of Shifting Composition of the Economy Purposeful Innovation & Sources of Innovative Opportunity; The Innovation Process; Innovative Strategies; Entrepreneurial Motivation; Entrepreneurs versus inventors; Ethics and International Entrepreneurship; Strategic Issues in International Entrepreneurship; Problem solving Innovation and Diversification.

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

CO1. Demonstrate the principles of business innovation and entrepreneurship for establishing industrial ventures.

CO2. Analyze business plans for potential investors and stakeholders and effectively answer probabilistic questions on the substance of plan.

CO3. Develop a comprehensive and well planned business structure for a new venture.

CO4. Conduct investigation on complex problems, towards the development of Project.

CO5. Apply modern statistical and mathematical tools to design projects and subsequent work procedures.

CO6. Apply ethics in constructive innovation framework.

CO7. Exhibit professionalism by employing modern project management and financial tools.

DETAILED SYLLABUS:

UNIT - I: Creativity and Innovation (07 Periods)

Introduction, Levels of innovation, Purposeful innovation and the sources of innovative opportunity, The innovation process, Innovative strategies, Strategies that aim at introducing and innovation, Dynamics of ideation and creativity – Inbound, Outbound; Context and process of new product development, Theories of outsourcing.

UNIT - II: Paradigms of Innovation (11 Periods)

Systems approach to innovation, Innovation in the context of developed economies and Emerging economies, Examining reverse innovation and its application, Performance gap, Infrastructure gap, Sustainability gap, Regulatory gap, Preference gap, organizational factors effecting innovation at firm level.

UNIT - III: Sources of finance and venture capital
(07 Periods)

Importance of finance, Comparison of venture capital with conventional development capital, Strategies of venture funding, Investment phases, Investment process, Advantages and disadvantages of venture capital, Venture capital developments in India.

UNIT - IV: Intellectual property innovation and Entrepreneurship (11 Periods)

Introduction to Entrepreneurship, Evolution of entrepreneurship from economic theory, Managerial and entrepreneurial competencies, Entrepreneurial growth and development, Concepts, Ethics and Nature of International Entrepreneurship, Intellectual property – forms of IP, Patents, Trademarks, Design registration, Copy rights, Geographical indications, Patent process in India.

UNIT - V: Open Innovation framework & Problem solving
(09 Periods)

Concept of open innovation approach, Difference between open innovations and Cloud innovation approaches, Limitations and

Opportunities of open innovation framework, Global context of strategic alliance, Role of strategic alliance, Problem Identification and Problem Solving, Innovation and Diversification.

Total Periods: 45

TEXT BOOKS:

1. Vinnie Jauhari, Sudhanshu Bhushan, *Innovation Management*, Oxford University Press, 1st Edition, 2014.

2. Drucker, P. F., *Innovation and Entrepreneurship*, Taylor & Francis, 2nd Edition, 2007.

REFERENCE BOOKS:

1. Robert D Hisrich, Claudine Kearney, *Managing Innovation and Entrepreneurship*, Sage Publications, 1st Edition, 2014.

2. V.K.Narayanan, *Managing Technology and Innovation for Competitive Advantage*, Pearson India, 1st Edition, 2002.

III B. Tech. — II Semester

(16BT60311) MATERIALS SCIENCE

(Common to CE, ME, CSE, IT & CSSE)

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Structure and Bonding in metals; Steels, Cast Irons and Non Ferrous alloys; Material Selection for conductors, Insulators and semi conductors; Strengthening mechanisms of metals; Plastics and Ceramics as Insulators; AC and DC properties of Insulators; Semiconductors and Magnetic materials; Composite materials in Electrical and Electronics engineering; Material Selection and manufacturing of Optical fibers.

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

CO1. Demonstrate the knowledge on concepts of fundamental science and engineering principles relevant to materials.

CO2. Analyze the structures of various types of Ferrous, Non ferrous alloys influencing various engineering applications.

CO3. Conduct investigations to select suitable materials with desired properties for engineering applications.

CO4. Use phase diagrams to interpret the data regarding microstructure of materials.

CO5. Consider health and safety issues while providing materials to real time applications.

CO6. Use composite materials that reduce material waste in design and manufacturing for sustainability.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION TO MATERIAL SCIENCE

(07 periods)

Structure of metals: Bonds in Solids, Crystallization of metals, Grain and grain boundaries, Effect of grain boundaries on the properties of metals / alloys, Determination of grain size measurement.

Constitution of alloys: Necessity of alloying, Types of solid solutions, Hume rothery rules, Intermediate alloy phases.

UNIT - II: CAST IRONS, STEELS & NON-FERROUS METALS
(12 periods)

Structure and properties of Grey cast iron, Spheroidal cast iron, White Cast iron, Malleable Cast iron, Alloy cast irons, Classification of steels, structure and properties of plain carbon steels, Structure and properties of Copper and its alloys, Aluminum and its alloys.

UNIT - III: ELECTRIC CONDUCTORS & INSULATORS
(12 periods)

Type of materials selected for conductors, Insulators and semi conductors, Introduction to ceramics - Bonding and microstructure, DC properties of ceramic materials, AC properties of ceramic materials, mechanical properties, Ceramics as Conductors, Insulators and capacitors; Introduction to Plastics - DC properties, AC properties, Mechanical properties.

UNIT - IV: SEMICONDUCTORS AND MAGNETIC MATERIALS
(09 Periods)

Fabrication of Semiconductors, Producing a silicon wafer- Lithography and Deposition packaging of semiconductors materials; Types of magnetic materials, Measuring magnetic properties, Application of soft magnetic materials in Electromagnets and relays, AC transformers, Generators and motors.

UNIT - V: ADVANCED MATERIALS AND APPLICATIONS
(05 periods)

Composites - Fiber reinforced metal matrix, Ceramic matrix, Polymer matrix, Properties and applications of composites; Ceramics - Alumina, Zirconia, Silicon Carbide, SiAlONs, Reaction Bonded Silicon Nitride (RBSN); Glasses- properties and applications, manufacturing of optical fibers.

Total Periods: 45

TEXT BOOKS:

1. Kodgire V D, *Material Science and Metallurgy*, Everest Publishing House, Pune, 31st edition, 2011.

2. Ian. P.Jones, *Material Science for Electrical and Electronic Engineers*, Oxford University Press, 1st Edition, 2000

REFERENCE BOOKS:

1. V. Raghavan, *Physical Metallurgy: Principles and Practices*, PHI, New Delhi, 2nd edition, 2006.

2. William. D. Callister, *Materials Science & Engineering-An Introduction*, John Wiley and Sons, New Delhi, 6th edition, 2002.

III B. Tech. - II Semester

(16BT70412) GREEN TECHNOLOGIES

(Common to CE, ME, CSE, IT & CSSE)

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Principles of green engineering; Green communications; Green energy; Green computing; Green construction; Green manufacturing.

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

CO1. Deploy conceptual knowledge in green technologies pertaining to engineering practice.

CO2. Analyze various green technologies for engineering practice.

CO3. Provide green solutions to engineering problems.

CO4. Apply various green techniques in the engineering practice.

CO5. Consider health and safety issues while providing green solutions to the society.

CO6. Understand issues related to environment sustainability.

CO7. Apply ethical standards for environmental sustainability in the engineering practice.

DETAILED SYLLABUS:

UNIT-I: PRINCIPLES OF GREEN ENGINEERING AND GREEN COMMUNICATIONS   (11 Periods)

Principles of Green Engineering:

Introduction, Definition of green engineering, Principles of green engineering.

Green Communications:

Introduction, Origin of Green Communications, Energy Efficiency in Telecommunication systems, Telecommunication system model and energy Efficiency, Energy saving concepts, Quantifying energy efficiency in ICT, Energy efficiency metrics of green

wireless networks, Embodied energy of communication devices-Introduction, The extended energy model, Embodied/Operating Energy of a BS in Cellular network- A Case study; Energy efficient standards for wireline communications.

UNIT-II: GREEN ENERGY (09 Periods)

Introduction, adverse impacts of carbon emission, control of carbon emission– methods, greenhouse gas reduction – methods, Energy sources and their availability, Green energy for sustainable development. Green energy sources – Solar energy, Wind energy, Fuel cells, Biofuels, Wave and Geothermal energy (Principle of generation only).

UNIT-III: GREEN IT (09 Periods)

The importance of Green Information technologies, Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication and Social Media, Regulating Green IT- Laws, Standards and Protocols; RoHS, REACh, WEEE, Legislating for GHG Emissions and Energy Use of IT Equipment, Non-regulatory Government Initiatives, Industry Associations and Standard Bodies, Green Building Standards, Green Data Centres, Social Movements and Greenpeace, Conclusions.

UNIT-IV: GREEN CONSTRUCTION (09 Periods)

Green Building: Definition, Typical features, Benefits, Requisites for green building construction, Sustainability, Concept of REDUCE, REUSE, RECYCLE, RETHINK, REPLENISH AND REFUSE (6 R's), Sustainable construction focus point – Site selection, Planning, Water, Energy, Material, Indoor air quality, Construction procedures.

Indian Green Building Council: Introduction to IGBC green homes, Benefits of IGBC, IGBC green home rating system, Introduction to USGBC, LEED rating system, Procedure to get IGBC certification, GRIHA Rating.

UNIT-V: GREEN MANUFACTURING (09 Periods)

Introduction, background, definition, motivation and barriers to green manufacturing, Impact of manufacturing in environmental ecology, Need for green manufacturing, Advantages and Limitations, green manufacturing strategies,

Green manufacturing and sustainability, Sustainability tools; Waste stream mapping and application, Green manufacturing through clean energy supply, green lean manufacturing, green packaging and supply chain.

Total Periods: 47

TEXT BOOKS:

1. Konstantinos Samdanis, *Peter Rost, Andreas Maeder, Michela Meo, Christos Verikoukis, Green Communications: Principles, Concepts and Practice*, John Wiley & Sons, 2015.

2. Soli J. Arceivala, *Green Technologies for a better future*, McGraw Hill Education (India) Pvt Ltd, 2014.

3. San Murugesan, G.R. Gangadharan, *Harnessing Green IT – Principles and Practices*, John Wiley & Sons Ltd., 2008.

4. Tom Woolley, Sam Kimmins, *Paul Harrison and Rob Harrison, Green Building Handbook*, Volume 1, E & FN Spon, an imprint of Thomson Science & Professional.

5. IGBC Green Homes Rating System Version 1.0 – A bridged reference guide.

6. J Paulo Davim, *Green Manufacturing: Processes and Systems*, Springer, 2012

7. David A Dornfeld, *Green Manufacturing: Fundamentals and Applications*, Springer, 2013

REFERENCE BOOKS:

1. Athanasios V Alavanidis, Thomais Vlachogianni, *Green Chemistry and Green Engineering*, Synchrona Themata, 2012.

2. G.D. Rai, *Non-conventional Energy Sources*, Khanna Publishers, Delhi, 5th edition, 2011.

3. Marty Poniatowski, *Foundation of Green Information Technology*, Prentice Hall, 2009.

4. R. K. Gautham, *Green Homes*, BS publications, 2009.

III B. Tech. - II Semester

(16BT70413) INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY

(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Introduction to the concept of nano; Description of nanomaterial; Nanostructure characterization tools; Classification of nanomaterials; Fabrication of nanomaterial; Different applications of nanostructures and nanomaterials.

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

CO1. Demonstrate knowledge in

- Nanoscale technology.
- Difference between micro and nanotechnology
- Classification of Nanostructure and Nanomaterial
- Fabrication of various nanomaterials and nano-structures.

CO2. Analyze numerical and analytical problems in

- Nanomaterial size by using Scanning Electron Microscope and X-Ray diffraction

CO3. Design and fabricate devices based on nanostructures like

- Nano solar cell
- Nano cantilever
- Nano bio-sensor

CO4. Synthesize nano particle of different materials to solve the problems related to fabrication of nanostructures.

CO5. Select appropriate technique for fabrication of nanostructures and nanocomposites.

CO6. Apply ethical standards and legal issues while using chemical substances in fabrication of new nanostructures.

DETAILED SYLLABUS:

UNIT-I: FUNDAMENTALS OF NANOTECHNOLOGY

(08 Periods)

Introduction – Scientific revolutions, Time and length scale in structures, Definition of a nanosystem; Dimensionality and size dependent phenomena - Surface to volume ratio Fraction of surface atoms, Surface energy and surface stress, surface defects, Properties at nanoscale (optical, mechanical, electronic, and magnetic).

UNIT-II: IDENTIFICATION AND CHARACTERIZATION TOOLS FOR NANOMATERIALS AND NANOSTRUCTURE (10 Periods)

Field Emission Scanning Electron Microscopy (FESEM), Environmental Scanning Electron Microscopy (ESEM) High Resolution, Transmission Electron Microscope (HRTEM), Scanning Tunneling Microscope(STM), Surface enhanced Raman spectroscopy (SERS), Secondary Ion Mass Spectroscopy, Focused Ion Beam Photoelectron Spectroscopy, X-ray Photoelectron Spectroscopy (XPS), Auger electron spectroscopy (AES), Rutherford backscattering spectroscopy (RBS), X-Ray Diffraction, Intensities in X-Ray Scattering Particle Size Effect.

UNIT-III: CLASSIFICATION OF NANOMATERIALS

(10 Periods)

Classification based on dimensionality, Quantum Dots, Wells and Wires-III-V Nanoparticles, Electronic Structure of Nanosemiconductor, Carbon based nanomaterials (buckyballs, nanotubes, graphene), Metal based nano materials (nanogold, nanosilver and metal oxides), Nanocomposites, Nanopolymers, Nanoglasses, Nano ceramics, Biological nanomaterials, Fulrene-discovery and early years,.

UNIT-IV: SOME FABRICATION TECHNIQUES OF NANO-MATERIALS AND NANOSTRUCTURES (09 Periods)

Chemical Methods: Metal Nanocrystals by Reduction, Solvothermal Synthesis, Photochemical Synthesis, Sonochemical Routes, Chemical Vapor Deposition (CVD), Metal Oxide Chemical Vapor Deposition (MOCVD), Plasma Enhanced Chemical Vapour Deposition Technique (PECVD), Hydrothermal Method, Sol-Gel.

Physical Methods: Ball Milling, Electrodeposition, Spray Pyrolysis, Flame Pyrolysis, DC/RF Magnetron Sputtering, Molecular Beam Epitaxy (MBE) Thermal Evaporation Method.

UNIT-V: APPLICATIONS   **(08 Periods)**

Solar energy harvesting, Catalysis, Molecular electronics and printed electronics Nanoelectronics, Polymers with a special architecture, Liquid crystalline systems, Linear and nonlinear optical and electro-optical properties, Applications in displays and other devices, Nanomaterials for data storage, Photonics, Plasmonics, Chemical and biosensors, Nanomedicine and Nanobiotechnology, MESFET.

Total Periods: 45

TEXT BOOKS:

1. Pradeep T., *A Textbook of Nanoscience and Nanotechnology*, Tata McGraw Hill Education Pvt. Ltd., 2012.

2. Hari Singh Nalwa, *Nanostructured Materials and Nanotechnology*, Academic Press, 2002.

REFERENCE BOOKS:

1. Nabok A., *Organic and Inorganic Nanostructures*, Artech House, 2005.

2. Dupas C., Houdy P., *Lahmani M., Nanoscience: Nanotechnologies and Nanophysics*, Springer - Verlag Berlin Heidelberg, 2007.

3. S.M. Sze, *Physics of Semiconductor Devices*, 2nd Edition 2001.

III B. Tech. – II Semester

(16BT60505) ENGINEERING SYSTEM ANALYSIS AND DESIGN

(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Systems Process; Technologies for Systems; System Development Life Cycle; System Analysis and Modeling; Levels of Management; Project Management; Systems Implementation and Importance of UML Prototyping; Maintaining and Managing the Systems Output Process.

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

CO1.   Demonstrate knowledge in

- Systems Process and System Design

- Systems Analysis and Modeling

- System Development Life Cycle

- Design Management and Maintenance Tools.

CO2.   Analyze System Process and estimate the given models by using case tools.

CO3.   Design and Develop a model to the organizational systems.

CO4.   Solve complex problems related to engineering systems and produce accurate results.

CO5.   Apply object oriented techniques for modeling dynamic systems.

CO6.   Contribute towards societal issues and responsibilities in designing, modeling and developing of organizational systems.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTION   (09 periods)

Systems, Types of systems, Integrating technologies for systems, Need for system analysis and design, Role of the

systems analyst, System development life cycle, CASE tools for analysis and design.

UNIT—II: ANALYSIS AND MODELING ORGANIZATIONAL SYSTEM (09 periods)

Organization as system, System analysis, Depicting systems graphically, Use case modeling, Levels of management, Organizational culture.

UNIT—III: PROJECT MANAGEMENT (10 periods)

Project initiation, Problem in organization, Determining feasibilities, Ascertaining hardware and software needs, Identifying, Forecasting, Comparing costs and benefits, Activity planning and control, Managing the project.

UNIT-IV: OBJECT ORIENTED ANALYSIS AND DESIGN USING UML (08 periods)

Introduction, Object modeling, Dynamic modeling, functional modeling, packages and other UML artifacts, the importance of using UML for modeling.

UNIT-V: DESIGNING EFFECTIVE OUTPUT (09 periods)

Output design objectives, Relating output content to output method, Realizing how output bias affects users, Designing output for display, Case studies-Designing a web site management, Online exam management, Online portal design.

Total Periods: 45

TEXT BOOK:

1. Kenneth E. Kendall and Julie E. Kendall, *System Analysis and Design*, Pearson Education, Ninth Edition, 2011.

REFERENCE BOOKS:

1. Dennis, Wixom and Roth, *Systems Analysis and Design*, John Wiley, Fifth Edition, 2012.

2. Shelly and Rosenblatt, *Systems Analysis and Design*, Cengage Learning, Ninth Edition, 2012.

III B.Tech. — II Semester

(16BT71011) MICRO-ELECTRO-MECHANICAL SYSTEMS

(Common to CE, ME, CSE, IT & CSSE)

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Overview of Micro Electro Mechanical Systems (MEMS); scaling laws; working principles of microsensors and microactuators; materials; microfabrication processes; packaging of Microsystems.

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

CO1. Demonstrate knowledge on MEMS devices, scaling laws, microsensors and microactuators

CO2. Analyze the properties of materials and identify its suitability for MEMS devices.

CO3. Design MEMS devices that meet desired specifications and requirements.

CO4. Analyze and synthesize the information to provide effective solution to engineering problems with MEMS devices.

CO5. Use modern techniques in micro manufacturing process.

CO6. Develop efficient and cost effective MEMS based products for society.

DETAILED SYLLABUS:

UNIT-I: OVERVIEW OF MEMS AND SCALING LAWS

(09 Periods)

MEMS and Microsystems, Microsystems and microelectronics, miniaturization, applications of MEMS in the automotive industry and in other industries.

Scaling laws of miniaturization: Introduction to scaling, scaling in: geometry, rigid- body dynamics, electrostatic forces, electromagnetic forces, Electricity, Fluid mechanics, Heat transfer.

UNIT -II: **WORKING PRINCIPLES OF MICROSYSTEMS**
(09 Periods)

Microsensors, acoustic wave sensors, biomedical and biosensors, chemical sensors, pressure sensors, thermal sensors. Microactuation: actuation using thermal forces, shape-memory alloys, piezoelectric crystals, electrostatic forces. MEMS with microactuators, microgrippers, micromotors, microvalves, micropumps. Microaccelerometers, microfludics.

UNIT-III: MATERIALS FOR MEMS AND MICROSYSTEMS
(09 Periods)

Substrate and wafers, silicon as a substrate material, silicon compounds, silicon piezoresistors, gallium arsenide, quartz, piezoelectric crystals, polymers, carbon nano tube (CNT), development of CNTs, application of CNTs.

UNIT-IV: MEMS FABRICATION PROCESS AND MICROMANUFACTURING **(09 Periods)**

Photolithography, ion implantation, diffusion, oxidation, chemical vapor deposition, physical vapor deposition, deposition by epitaxy, etching, bulk micromanufacturing, surface micromanufacturing, LIGA process.

UNIT-V: MEMS PACKAGING **(09 Periods)**

Introduction to microsystem packaging, objectives and general considerations in packaging design, three levels of microsystem packaging, interfaces in microsystem packaging, packaging technologies, three-dimensional packaging, selection of packaging materials, signal mapping and transduction, Design case: Pressure sensor packaging.

Total Periods: 45

TEXT BOOK:

1. Tai-Ran Hsu, *MEMS & Microsystems, Design and Manufacture*, McGraw Hill Education (India) Pvt. Ltd., 2002.

REFERENCES BOOKS:

1. G.K.Ananthasuresh, K.J.Vinoy, *Micro and Smart Systems*, Wiley India, 2010.

2. Nitaigour Premchand Mahalik, *MEMS,* McGraw Hill Education (India) Pvt. Ltd., 2007.

III B. Tech. – II Semester

(16BT61205) CYBER SECURITY AND LAWS

(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Cyber Crimes and Indian IT Act; Cyber Offenses; Tools and Methods used in Cyber Crime; Phishing ad Identity Theft; Indian and Global Perspective on Cyber Crimes and Cyber Security; Organizational Implications on Cyber Security; IPR Issues; Cyber Crime and Terrorism; Cyber Crime Illustrations.

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

CO1. Demonstrate knowledge in Cyber security, Cyber crimes and its related laws in Indian and Global Act.

CO2. Analyze the legal perspectives and laws related to cyber crimes in Indian context.

CO3. Apply security and privacy methods in development of modern applications and in organizations to protect people and to prevent cyber crimes.

CO4. Solve Cyber security issues using privacy policies.

CO5. Use antivirus tools to minimize the impact of cyber threats.

CO6. Follow security standards for the implementation of Cyber Security and laws.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO CYBER CRIMES AND OFFENSES (09 Periods)

Cyber Crimes: Introduction, Definition, Origin, Cyber crime and information security, Cyber criminals, Classifications of cyber crimes, The legal perspectives and Indian perspective, Cyber crime and Indian ITA 2000, Global perspective on cyber crimes.

Cyber Offenses: Introduction, Criminals planning on attacks, Social engineering, Cyber stalking, Cyber cafe and crimes, Botnets.

UNIT-II: TOOLS AND METHODS USED IN CYBER CRIME & PHISHING AND IDENTITY THEFT   (09 Periods)

Introduction, Proxy servers and Anonymizers, Phishing, Password cracking, Key loggers and Spywares, Virus, Worms and Ransomware, Trojan horses and Backdoors, Steganography, DoS and DDoS attacks.

Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).

UNIT-III: CYBER CRIMES AND CYBER SECURITY-LEGAL PERSPECTIVES   (08 Periods)

Introduction, Cyber laws in Indian context, The Indian IT act, Challenges to Indian law and Cyber crime scenario in India, Consequences of not addressing the weakness in IT act, Digital signatures and the Indian IT Act, Cyber Crime and Punishment, Cyberlaw, Technology and Students in India scenario.

UNIT-IV: CYBER SECURITY-ORGANIZATIONAL IMPLICATIONS   (10 Periods)

Introduction, Web threats for organizations – evils and perils, Security and privacy implications from cloud computing, Social Media Marketing-Security risks and Perils for organizations, Social computing and associated challenges for organizations, Protecting people's privacy in organization, Organizational guidelines for internet usage, Safe computing and Usage policy, Incident handling and Best practices.

UNIT-V: CYBER CRIME & TERRORISM AND ILLUSTRATIONS   (09 Periods)

Cyber Crime & Terrorism: Introduction, Intellectual property in the cyber space, The ethical dimension of cyber crimes, The psychology, Mindset and skills of hackers and cyber criminals, Sociology of cyber criminals, Information warfare.

Cyber Crime Illustrations: Indian banks lose millions of rupees, Justice vs. Justice, Parliament attack, The Indian case of online gambling, Bank and credit card related frauds, Purchasing goods and services scam, Nigerian 419 scam.

Total Periods: 45

TEXT BOOK:

1. Nina Gobole and Sunit Belapure, *Cyber Security: Understanding Cyber Crimes*, Computer Forensics and Legal Perspectives, Wiley India, 2011.

REFERENCE BOOK:

1. Prashant Mali, *Cyber Law and Cyber Crimes*, Snow White Publications Pvt. Ltd., 2013.

III B.Tech. – II Semester
(16BT61505) BIOINFORMATICS
(Common to CE, ME, CSE, IT & CSSE)
(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITE: —

COURSE DESCRIPTION: Introduction to Bioinformatics; Biology and Information; Sequence alignment and dynamic programming; Biological Database; Homology Modeling; Structure Prediction; Molecular Dynamics

COURSE OUTCOMES: On successful completion of this course, student will be able to:

CO1. Demonstrate knowledge on concepts of biological databases, Genome and proteome.

CO2. Analyze biological sequences for Homology Modeling.

CO3. Apply clustering methods for Phylogenetic trees.

CO4. Solve bio sequencing problems using dynamic programming.

CO5. Select and apply appropriate techniques and tools to structure Prediction

DETAILED SYLLABUS:

UNIT-I: NUCLEIC ACIDS, PROTEINS AND AMINO ACIDS
(08 periods)

Bioinformatics-Definition, Nucleic acid structure, Protein structure, the central dogma, Physico-chemical properties of the amino acids and their importance in protein folding, Polymerase chain reaction (PCR)

UNIT-II: INFORMATION RESOURCES FOR GENES AND PROTEIN   (10 periods)

Database file formats, Nucleic acid sequence databases, Protein sequence databases

Sequence Alignment Algorithm

Pair wise sequence alignment – The problem, Pair wise sequence alignment – Dynamic programming methods, The effect of scoring parameters on the alignment, Multiple sequence alignment

UNIT-III: PREDICTION OF THE THREE-DIMENSIONAL STRUCTURE OF A PROTEIN AND HOMOLOGY MODELING   (09 Periods)

Secondary Structure Prediction, Basic Principles, The Steps of Comparative Modeling, Accuracy of Homology Models, Manual versus Automatic Models, SNPs, Motifs.

UNIT-IV: PHYLOGENETIC METHODS   (10 periods)

Phylogenetic trees, choosing sequences, Distance matrices and clustering methods, Calculation of distances in the neighbor-joining method, Bootstrapping, Tree optimization criteria and tree search methods, The maximum-likelihood criterion, Calculating the likelihood of the data on a given tree, The parsimony criterion.

UNIT-V: NEW FOLD MODELING   (08 periods)

Estimating the Energy of a Protein Conformation, Energy Minimization, Molecular Dynamics,

The "Omics" Universe-Transcriptomics, Proteomics, Interactomics, Structural Genomics, Pharmacogenomics.

Total Periods:45

TEXT BOOKS:

1.   Paul G. Higgs and Teresa K. Attwood, *Bioinformatics and Molecular Evolution*, Blackwell Publishing 2005.

2.   Anna Tramontano, *Introduction to Bioinformatics*, Chapman and Hall/CRC, 2006.

REFERENCE BOOKS:

1. Hooman H. Rashidi and Lukas K. Buehler, *Bioinformatics Basics, Applications in Biological Science and Medicine*, CRC Press, Taylor & Francis Group, 2nd Edition, 2005.

2. Rastogi S. C., Namita Mendiratta and Parag Rastogi, *Bioinformatics: Methods and Applications: Genomics*, Proteomics and Drug Discoveryn, PHI Learning Pvt. Ltd., Third Edition, 2011.

III B. Tech. - II Semester
(16BT60331) **CAD AND SIMULATION LAB**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Course on Computer Aided Machine Drawing Lab.

COURSE DESCRIPTION: Fundamental Concepts of CAD and Simulation; 2D and 3D Part Modeling; Analysis of Simple Structural, Thermal and CFD problems.

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

CO1. Demonstrate basic knowledge to use software package CREO to generate 3D models of parts and assemblies, and choose appropriate module of ANSYS to perform stress, thermal and CFD analysis.

CO2. Analyze any part or machine component in a standardized manner suitable for industrial scenarios.

CO3. Design components and analyze for various required parameters.

CO4. Conduct investigation on complex subsystem and employ bottom- up approach to build the model of the entire system and generate drawings or models.

CO5. Apply appropriate hardware and software for CAD and Simulation thereby enhancing productivity in design.

CO6. Contribute to the society and engineering profession based on standard engineering norms and practices in design.

CO7. Function effectively as an individual and as a member of team to combine various part components into a single assembly.

CO8. Communicate effectively about any mechanical components or system.

LIST OF EXPERIMENTS

ANY **TWELVE** EXPERIMENTS ARE TO BE CONDUCTED.

1. Exercises (2-D & 3-D) using design packages:

    a) Drafting: Development of part drawings for various components in the form of orthographic and isometric, Representation of dimensioning and tolerances scanning and plotting.

    b) 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.

2. Exercises using Analysis software:

    a) Structural Analysis:

    - Determination of deflection and stresses in 2D trusses and beams.

    - Determination of deflections component and principal and Von-Mises stresses in simple 3D plane and axisymmetric components.

    b) Thermal Analysis:

    - Steady state heat transfer Analysis of plane and axisymmetric components.

    - 2D problem with conduction and convection boundary conditions.

    c) Computational Fluid Dynamics(CFD) Analysis:

    - Simple fluid flow and heat transfer problems.

    - Modeling Periodic flow and heat transfer.

    - Modeling external compressible flows.

    - Modeling transient compressible flows.

    - Modeling radiation and natural convection.

Note: Any Two Software Packages from each of the module

CAD Packages: SOLIDWORKS, CATIA, Unigraphics, Solid Edge, CREO.

Analysis Packages: HyperMesh, ANSYS, Openfoam, STAR CCM+.

III B. Tech. – II Semester
(16BT60332) HEAT TRANSFER LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Course on Heat Transfer.

COURSE DESCRIPTION: Experimental studies on mechanisms of heat transfer; Film wise and drop wise condensation; Steady and unsteady flow; Effectiveness of heat exchanger; thermal conductivity; emissivity; Stefan - Boltzmann constant.

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

CO1. Demonstrate the knowledge of heat transfer phenomenon in objects of different geometries.

CO2. Identify, formulate and analyze various heat transfer problems.

CO3. Design various thermal systems and conduct experiments to increase/decrease heat transfer rates.

CO4. Investigate the results obtained in the various experiments and provide suitable conclusions.

CO5. Apply dimensional analysis to evaluate the performance of heat transfer equipment.

CO6. Work and contribute to team to accomplish common goals.

CO7. Communicate effectively about laboratory work reports and presentations.

Any TWELVE Experiments should be conducted

LIST OF EXPERIMENTS:

1. Determination of Thermal conductivity of metal rod using thermal conductivity Apparatus.

2. Determination of Overall heat transfer co-efficient through Composite Slab Apparatus.

3. Determination of Thermal conductivity of insulating powder material through concentric sphere apparatus.

4. Determination of Thermal conductivity of insulating material by lagged pipe apparatus.

5. Determination of Temperature distribution and heat transfer rate in Transient heat conduction mode using Transient heat conduction apparatus.

6. Determination of Convective Heat transfer coefficient in natural convection using natural convection apparatus.

7. Determination of Convective Heat transfer coefficient in forced convection using forced convection apparatus.

8. Determination of Critical heat flux using Critical Heat flux apparatus.

9. Determination of Heat transfer in drop and film wise condensation using drop and film wise condensation apparatus.

10. Determination of overall heat transfer coefficient of Parallel and counter flow heat exchanger using Parallel and counter flow heat exchanger Apparatus.

11. Determination of Temperature distribution, efficiency and effectiveness of Pin- Fin using pin-fin Apparatus.

12. Determination of Emissivity of a gray body using Emissivity apparatus.

13. Determination of Stefan Boltzmann constant using Stefan Boltzmann Apparatus.

14. Study of two phase heat flow.

15. Study of heat pipe and its demonstration.

NOTE: Heat Transfer data books are permitted in the examinations.

III B. Tech – II Semester
(16BT60333) SEMINAR

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	100	100	-	-	-	2

PRE-REQUISITES: —

COURSE DESCRIPTION: Identification of topic for the seminar; Literature survey; Performing critical study and analysis of the topic identified; Preparation of report and presentation.

COURSE OUTCOMES: Completion of the seminar work enables a successful student to demonstrate:

CO1. Knowledge on the seminar topic.

CO2. Analytical ability exercised during the seminar work.

CO3. Ability to investigate and solve complex engineering problems faced during the seminar work.

CO4. Ability to apply techniques to complex engineering activities with an understanding of limitations as applied in the seminar work.

CO5. Ability to function effectively as an individual as experienced during the seminar work.

CO6. Ability to present views cogently and precisely on the seminar topic.

CO7. Ability to engage in life-long leaning as experience during the seminar work.

IV B. Tech – I Semester

(16BT70301) AUTOMOBILE ENGINEERING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Thermal Engineering-I.

COURSE DESCRIPTION: Basic components and classification of automobiles; Fuel Supply System; Cooling System; Ignition System; Emissions from automobiles; Pollution control Techniques; Transmission System; Steering System; Suspension and Braking System.

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

CO1. Demonstrate the knowledge on working of various components of an automobile.

CO2. Identify and analyze the various systems and sub systems suitable for an automobile.

CO3. Present the probable solution in the design of fuel systems, cooling and ignition systems, transmission systems, steering systems, suspension and braking systems of an automobile.

CO4. Investigate the complex issues in automobile engineering and provide valid conclusions.

CO5. Use the techniques to estimate pollution from the emissions of automobiles.

CO6. Use the national and international standards to assess the emissions from automobiles considering health and safety.

DETAILED SYLLABUS:

UNIT - I: BASICS OF AN AUTOMOBILE   (12 periods)

Classification of automobiles, Components of a four wheeler automobile, Chassis and body, Rear wheel drive, Front wheel drive, Four wheel drive, Turbo charging, Super charging, Oil filters, Oil pumps.

Fuel system: S.I. Engine - Fuel supply system, Mechanical and electrical fuel pump, Air and fuel filters, Carburetor types; C.I. Engine - Requirements of diesel injection systems, Types of injection systems, Fuel pump, Types of nozzles, Nozzle spray formation, Injection timing.

UNIT - II: COOLING & IGNITION SYSTEMS   (10 Periods)

Cooling systems: Necessity of cooling system, Requirements of cooling systems, Types, Natural and Forced Circulation System, Thermostat, Types of radiators, Cooling Fan, Water pump, Antifreeze solutions.

Ignition systems: Function of an ignition system, Battery ignition system, Magneto coil ignition system, Electronic ignition system using contact breaker, Capacitive discharge ignition system.

UNIT - III: EMISSIONS FROM AUTOMOBILES (06 periods)

National and international Pollution standards, Pollution Control Techniques for SI engines and CI engines, Comparison of electronic catalytic converter and conventional catalytic converter, Alternative energy sources for automobiles, Emissions from alternative energy sources - Hydrogen, Biomass, Alcohols, LPG, CNG, Bio-diesel - Their merits and demerits.

UNIT - IV: TRANSMISSION & STEERING SYSTEMS

(11 periods)

Transmission systems: Types of clutches - Cone clutch, Single and multi plate clutch, Centrifugal clutch; Types of Gear box - Constant mesh, Sliding mesh, Synchromesh gear box; Gear shifting mechanism, Automatic transmission, Propeller shaft, Universal joint, Differential, Real axle arrangement.

Steering systems: Requirements and functions of steering system, Layout of steering system, Steering gears, Steering linkages; Under steering, Over steering, Steering ratio, Steering geometry - Camber, Caster, Toe-in, Toe out; Power steering, Wheel alignment and Balancing.

UNIT - V: SUSPENSION & BRAKE ACTUATING SYSTEMS
(06 periods)

Suspension systems: Requirements and functions of suspension system, Elements of suspension systems, Rigid axle

suspension system, Torsion bar, Shock absorber, Telescopic damper, Independent suspension system.

Brake actuating systems: Need and functions of braking system, Classification of brakes, Mechanical, Hydraulic, Pneumatic, Vacuum brake systems.

Total Periods: 45

TEXT BOOKS:

1. Dr. Kirpal Singh, *Automobile Engineering*, Vol.1&Vol.2, Standard Publishers distributor, 12th edition, 2011.

2. R.K.Rajput, *Automobile Engineering*, Lakshmi Publication, 2nd Edition, 2014.

REFERENCE BOOKS:

1. V.M.Domkundwar, *Automobile Engineering*, Dhanpat Rai & Co, 1st Edition, 2013.

2. V.Ganesan, *IC Engines*, Tata McGraw-Hill, 3rd Edition, 2007.

IV B. Tech. – I Semester
(16BT70302) FINITE ELEMENT METHOD

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Design of Machine Elements-II and Heat Transfer.

COURSE DESCRIPTION: Discretization; Formulation of finite element expression; Finite Element approach to solve 1-D problems; beams; trusses; CST problems; Heat transfer problems and Dynamic analysis problems.

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

CO1. Demonstrate principles and approaches for solving FEM problems in different fields.

CO2. Formulate and analyze element stiffness matrices and shape functions to find stresses in trusses and beams.

CO3. Develop solutions for CST element and axi-symmetric element.

CO4. Conduct investigation on heat transfer problems using FEM.

CO5. Apply finite element technique to solve vibration analysis problems.

CO6. Apply practical constraints to find solutions for structural and thermal problems.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION   **(09 Periods)**

Introduction to Finite Element Method for solving field problems, Stress and Equilibrium, Strain - Displacement relations, Stress - strain relations,

One-dimensional finite element methods: Bar elements, Finite element modeling, coordinates and shape functions, Element matrices, assembling of global stiffness matrix and load vector, Principle of minimum potential energy, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element.

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UNIT - II: TRUSSES & BEAMS (09 Periods)

Trusses: Plane trusses, local and global coordinate systems, formulation for direction cosines, Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, and temperature effects.

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

UNIT - III: TWO-DIMENSIONAL & AXI-SYMMETRIC MODELS (09 Periods)

Two dimensional problems: Basic concepts of plane stress and plane strain, stiffness matrix of Constant Strain Triangle (CST) element, finite element solution of plane stress problems.

Axi-symmetric model: Finite element modelling of axi-symmetric solids subjected to axi-symmetric loading with triangular elements.

UNIT - IV: ISO-PARAMETRIC FORMULATION & HEAT TRANSFER ANALYSIS (11 periods)

Iso-parametric formulation: Sub parametric, super parametric and iso-parametric elements, 2 dimensional 4 noded iso-parametric elements, numerical integration.

Heat transfer problems: One-dimensional finite element formulation of heat transfer with conduction, convection and Heat transfer through fins, Two-dimensional finite element formulation.

UNIT - V: DYNAMIC ANALYSIS (07 periods)

Introduction to dynamic considerations, Hamilton's principle, Dynamics of spring mass system, consistent mass matrix, Formulation of FEM model, element matrices, One-dimensional bar, truss, CST elements, Lumped mass matrices, Evaluation of Eigen values and Eigen vectors for a stepped bar and beam element.

Total Periods: 45

TEXT BOOKS:

1. Tirupati R. Chandrupatla & Ashok D. Belegundu, *Introduction to Finite Elements in Engineering*, PHI learning, 3rd Edition, 2011

2. Daryl L. Logan, *First course in the Finite Element Method*, Cengage Learning, 4th Edition 2007

REFERENCE BOOKS:

1. S. S. Rao, *Finite Element Methods in Engineering*, Elsevier, 5th Edition, 2012.

2. J. N. Reddy, *An Introduction to Finite Element Method*, Tata Mc Graw-Hill, 3rd Edition, 2005.

IV B. Tech. — I Semester
(16BT70303) OPERATIONS RESEARCH

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Industrial Engineering and Management

COURSE DESCRIPTION: Quantitative methods and techniques for effective decision making; model formulation and applications pertinent to business decision problems; mathematical tools for solving deterministic problems, linear programming formulation and optimization; transportation models; queuing models and simulation; Replacement models; Game theory.

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

CO1. Demonstrate knowledge on preparation of mathematical model for optimization in a given application.

CO2. Analyze a practical situation and apply appropriate methodology to solve the problem.

CO3. Design a system with optimum parameters to maximize the efficiency and minimize the wastage in selected situations.

CO4. Investigate alternate solutions for complex decision making problems.

CO5. Apply simulation tool to model the industrial systems.

CO6. Consider societal issues in solving industrial decision making problems for optimum benefits.

DETAILED SYLLABUS:

UNIT - I: LINEAR PROGRAMMING PROBLEM   (10 Periods)

Requirements of Linear Programming Problem, Formulation, Graphical solution, Simplex method, Two–phase method, Big-M method, Dual formulation, Dual simplex method, Linear Programming special cases- Infeasible solution, Unboundedness, Redundancy, alternate optimal solutions.

UNIT - II: TRANSPORTATION AND ASSIGNMENT MODELS
(10 Periods)

Transportation model: Methods to find basic feasible solution-North-West corner rule, Least cost method, Vogel'sapproximation method; Modified distribution (MODI) method to find optimal solution, Special cases of transportation problems, Transshipment problem.

Assignment model: Hungarian method, Variants of assignment problem, Travelling salesmen problem.

UNIT - III: GAME THEORY AND REPLACEMENT MODELS
(09 Periods)

Game theory: Two person zero sum games, Minimax (maximin) Criterion and optimal strategy, Solution of games with saddle points, Rectangular games without saddle points- 2 x 2 games (Algebraic method), m x 2 and 2 x n games (Graphical method) and m x n games (Dominance principle).

Replacement models: Replacement of single item that deteriorate with time: With change in value of money, Without change in value of money; Group replacement.

UNIT - IV: NETWORK MODELS (08 Periods)

Minimal spanning tree, maximal flow and shortest route techniques, Project management through network analysis- CPM, PERT, cost analysis and crashing.

UNIT - V: WAITING LINES AND SIMULATION (08 Periods)

Waiting Lines: Infinite queue length model with single Channel, Poisson arrivals, Exponential service times, Infinite queue length model with multi-Channel, Poisson arrivals and exponential service times.

Simulation: Monte Carlo simulation, Simulation of a waiting line problem, Simulation of inventory model, Simulation model for a maintenance policy, Verification and validation.

Total Periods: 45

TEXT BOOKS:

1. Hamdy A Taha, *Introduction to Operations Research*, Pearson India, 9th Edition, 2014

2. Kanti Swarup, P.K. Gupta, Manmohan, *Operations Research*, Sultan Chand & Sons, 2014.

3. J.K. Sharma, *Operations Research: Theory and Applications*, Macmillan, New Delhi, 5th Edition, 2013.

REFERENCE BOOKS:

1. Hillier, Libermann, *Introduction to Operations Research*, McGraw Hill Education (India) Private Limited, 9th Edition, 2011.

2. R Panneerselvam, *Operations Research*, PHI Learning Pvt. Ltd., 2nd Edition, 2012.

IV B. Tech. — I Semester
(16BT70304) CRYOGENICS
(Program Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Refrigeration & Air-conditioning

COURSE DESCRIPTION: Necessity of low temperature, Multi stage refrigeration, Cascade system, Properties of cryogenic fluids, Liquefication of air, hydrogen and helium, Applications of low temperature, Low temperature insulation, Storage systems.

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

CO1. Demonstrate the principles of cryogenics in various low temperature refrigeration applications.

CO2. Analyze the various refrigeration cycles in solving cryogenic problems.

CO3. Present the probable solution in the design of insulation to the various systems in handling the cryogenic fluids.

CO4. Conduct investigations cryogenic fluids suitable for low temperature applications in real time situations.

CO5. Apply the suitable storage and handling systems for various cryogenic fluids.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION   (09 Periods)

Necessity of low temperature, Limitations of vapour compression system for the production of low temperature, Multi-stage refrigeration system - Cascade system.

UNIT - II: PROPERTIES OF CRYOGENIC FLUIDS
(08 Periods)

Cryogenics - Definition, T-S diagram of a cryogen; Properties of cryogenic fluids - Liquid Methane, Liquid Neon, Liquid Nitrogen, Liquid Oxygen, Liquid Argon, Liquid Air.

UNIT - III: REFRIGERATION AND LIQUEFICATION
(09 Periods)

Manufacture of Dry ice, Joule's Thomson effect, Liquefication of air - Linde system, Claude system, Liquefication of Hydrogen and Helium.

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UNIT - IV: APPLICATIONS OF LOW TEMPERATURE
(09 Periods)

Effects on the properties of metals - Strength, Thermal properties, Super conductivity and Super fluidity; Applications of low temperature - Expansion fitting, Cryobiology, Cryosurgery, Space research, Computers and Underground power lines.

UNIT - V: LOW TEMPERATURE INSULATION   (10 Periods)

Types of Insulation - Reflective insulation, Evacuated powders, Rigid foams; Super insulation; Dewar vessels; Hazards in cryogenic engineering.

Total Periods: 45

TEXT BOOKS:

1. Domkundwar Arora Domkundwar, *A course in Refrigeration and Air-conditioning*, Dhanpat Rai Co., 7th Edition, 2002.

2. P L Ballany, *Refrigeration and Air-conditioning*, Khanna Publishers, 15th Edition 2009.

REFERENCE BOOKS:

1. Traugott H.K. Frederking and S.W.K. Yuan, *Cryogenics - Low Temperature Engineering and Applied Sciences*, Yutopian Enterprises, 2005.

2. A. R. Jha, *Cryogenic Technology and Applications*, Butterworth-Heinemann, 2005

IV B. Tech. — I Semester
(16BT70305) **GEOMETRIC MODELLING**
(Program Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on CAD/CAM.

COURSE DESCRIPTION: Basic concepts of coordinate systems; Bezier curves and surfaces, geometric continuity, curvature, subdivision, curve and surface fitting; Output primitives; 2-D and 3-D geometrical transformations and viewing; Surface detection methods and Computer Animation.

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

CO1. Demonstrate the knowledge on the Concepts of coordinate systems and Design Parameters involved in computer aided drawings.

CO2. Analyze higher degree curves using algorithms in geometric modeling.

CO3. Propose solutions which indulge with multiple 2-D and 3-D geometrical transformations to represent and solve real engineering problems.

CO4. Conduct investigations on intricate and non linear design projects involving geometric modeling.

CO5. Apply the visual surface detection methods such as solid works, Unigraghics, Ansys, Hyper mesh for new product design.

CO6. Consider societal issues while providing designs to real time applications.

DETAILED SYLLABUS:

UNIT - I: GRAPHICS CONCEPTS (2D and 3D)   (08 Periods)

Introduction to CAD process, Application area of Computer graphics, Output primitives-Points, Lines and Circles; Drawing algorithms, Transformations in Graphics – Coordinate systems,

2-D Transformations, Homogeneous and combination Transformations; 3-D Transformations-Projections, Techniques of Scan Conversion, Rendering, Hidden surface removal.

UNIT –II: MATHEMATICAL REPRESENTATION OF CURVES (09 Periods)

Types and Parametric Representations of Analytic Curves, Wire frame models, Wire frame entities, Parametric representation of synthetic curves - Hermite cubic splines, Bezier curves, B-splines rational curves; Curve Manipulations – Displaying, Evaluating points on Curves, Blending, Segmentation, Trimming, Intersection, Transformation.

UNIT –III: SURFACE MODELING (10 Periods)

Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces- plane surface, rule surface, surface of revolution; Tabulated Cylinder, Parametric Representation of Synthetic Surfaces- Hermite Bicubic surface, Bezier surface, B-Spline surface, Coons surface, Blending surface , Sculptured surface, Surface manipulation- Displaying, Segmentation, Trimming, Intersection.

UNIT –IV: SOLID MODELING (10 Periods)

Solid models, solid entities, Solid Representation, Fundamentals of Solid Modeling, Set Theory, Regularized Set Operations, Set Membership Classification; Boundary Representation (B-rep), Constructive Solid Geometry (CSG), Solid Manipulations, Displaying, Evaluating points, Curves and Surfaces on solids, Segmentation, Trimming, Intersection, Editing.

UNIT –V: ADVANCED MODELING CONCEPTS (08 Periods)

Feature Based Modeling, Assembling Modeling, Behavioral Modeling, and Conceptual Design & Top down Design, Capabilities of Modeling & Analysis Packages such as solid works, Unigraghics, Ansys, Hyper mesh, Computer Aided Design of mechanical parts and Interference detection by motion analysis.

Total Periods: 45

TEXT BOOKS:

1. David F Rogers, *Mathematical Elements for Computer Graphics*, TMH, 2nd Edition, 2002.

2. M.C. Trivedi, *Computer Graphics and Animation*, Jaico Publications, 2009.

REFERENCE BOOKS:

1. Donald Hearn and M.Pauline Baker, *Computer Graphics C version*, Pearson publication, Ist Edition, 2014.

2. Ibrahim Zeid, *CAD/CAM Theory and Practice*, TMH, 2009.

3. Zhigand Xiang, Roy Plastock, *Computer Graphics*, TMH, 2nd Edition, 2006.

IV B. Tech. – I Semester

(16BT70306) QUALITY MANAGEMENT AND RELIABILITY ENGINEERING

(Program Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Industrial Engineering and Management.

COURSE DESCRIPTION: Introduction to Quality, Quality Costs, Quality Circles, QC Tools, Statistical Quality Control, Control Charts, Acceptance Sampling Evaluation, Reliability, Types of Failures, Reliability Improvement.

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

CO1. Demonstrate knowledge on the concepts of standardization and bodies of standardization for improvement of quality.

CO2. Analyze sampling plans for continuous quality in production.

CO3. Develop failure hazard models to improve reliability.

CO4. Conduct investigations to identify active and standby redundancies for reliability optimization.

CO5. Use control charts and quality tools for inspection of quality.

CO6. Improve products and processes in accordance with the requirements for building and sustaining performance excellence.

CO7. Use the quality control codes and standards in the quality control processes.

DETAILED SYLLABUS:

UNIT - I: QUALITY AND QUALITY COSTS   (09 Periods)

Definition of Quality, Product Quality, Quality Control, Factors Affecting Quality, Stages of Evaluation, Continuous Improvement, Quality Management System, Quality Standards, Need for Standardization, Bodies of Standardization- ISO-9000 Series, ISO-14000 Series; ISO Certification Process, Quality Costs- Prevention, Appraisal, Internal Failure and External Failure costs, Quality Function Deployment (QFD), Tools for Continuous

Improvement- Deming cycle, Poka-Yoke, and Kaizen; Quality Circles- Concepts, Objectives and advantage, Introduction to Six Sigma Concept, Advantages; QC Tools.

UNIT - II: STATISTICAL QUALITY CONTROL   (09 Periods)

Introduction to SQC, Causes of Variation, Control Charts for Variables- X and R Charts; Interpretation of Control Charts, Control Charts for Attributes- P chart, C chart, U chart; Quality Rating System.

UNIT - III: ACCEPTANCE SAMPLING   (09 Periods)

Acceptance Sampling Plans for Attributes- Types of Sampling Plans, Advantages and Disadvantages of Sampling Plans; Evaluation of Sampling Plans, OC Curve- Characteristics of OC Curve, Producer Risk and Consumer Risk, AOQ, AQL, ATI, ASN; Brief Introduction to Acceptance Sampling Plans for Continuous Production and Acceptance Sampling Plan for Variables.

UNIT - IV: CONCEPTS OF RELIABILITY   (09 Periods)

Quality and Reliability, Importance of Reliability, Reliability Data Collection, Failure Data Analysis- MTTF, MTBF, Failure Rate, Hazard Rate, Failure Rate Curve; Types of Failures-Hazard Models (Exponential and Weibull); System Reliability with Components in Series, in Parallel and Mixed configurations.

UNIT - V: RELIABILITY IMPROVEMENT   (09 Periods)

Active and Standby Redundancies, Fault Tree Analysis, Reliability Optimization, Maintainability and Availability, Application of Reliability in Maintenance Strategies.

Total Periods: 45

TEXT BOOKS:

1. Dale H Besterfield et al, *Total Quality Management, Pearson Education*, 3rd edition, 2011.

2. 2. L S Srinath, *Reliability Engineering*, East west press, 4th edition, 2005.

REFERENCE BOOKS:

1. Howard Giltow, *Quality Management*, Tata McGrawhill, 3rd edition, 2008.

2. Amitava Mitra, *Fundamentals of Quality Control and Improvement*, Wiley, 3rd edition, 2013.

3. Grant E.L, *Statistical Quality Control*, McGraw Hill education (India) Pvt. Limited, 7th edition, 2005.

IV B.Tech. - I Semester
(16BT70307) **TOOL DESIGN**
(Program Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Machine Tools and Modern Machining Processes.

COURSE DESCRIPTION: Basic cutting parameters; Determination of cutting forces; Stresses and Strains; Importance of heat treatment in tool design; design of dies; design of single and multi-point cutting tools.

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

CO1. Demonstrate knowledge on the impact of cutting tool angles for various operations.

CO2. Analyse the cutting tool requirement and specify the material and geometry required for a given tool in a given machining situation.

CO3. Design single/multipoint cutting tools and jigs/fixtures for selected applications.

CO4. Interpret tolerances applicable to dies, jigs, fixtures and moulds.

CO5. Select the tool and other requirements for machining an object with complex geometry.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION TO CUTTING TOOLS (12 periods)

Introduction, Different types of cutting tools used for machining, Designation of cutting tools, Types of systems used for designating cutting tools, Selection and Desirable properties of tool material, Characteristics of tool Material, Principal tool materials - Ferrous and Non-ferrous tool materials, Non-metallic tool materials, Calculation of Forces and Design for Cutting Forces, Tool wear, Tool life criteria, variables affecting tool life and Machinability.

UNIT - II: DESIGN OF SINGLE POINT CUTTING TOOLS
(07 periods)

Introduction, Basic Elements, Design of Tool Shank, Geometry of single point cutting tool, Nomenclature of single point cutting tool, Influence of Various Angles on Tool Design, Mechanics of orthogonal cutting, Merchants force diagram, Geometry and their interrelation, Theories of formation of chip and their effect, Taylor's tool life equation.

UNIT - III: DESIGN OF MULTI POINT CUTTING TOOLS
(07 periods)

Introduction, Classification of multi point cutting tools, Drill geometry, Design of Drills, Rake & Relief angles of twist drill, Speed, Feed and depth of cut, Machining time, Forces, Milling cutters, Cutting speeds and Feed machining times-design-form cutters, combination tools, Reamers.

UNIT - IV: DESIGN OF DIES FOR SHEET METAL OPERATIONS
(10 Periods)

Design of sheet metal blanking and piercing: Fundamentals of die cutting operations, Power press- types, Material handling equipment, Cutting action in punch and die operation. Die clearance, Die design fundamentals-blanking and Piercing die construction.

Design of sheet metal bending, forming and drawings die:

Bending dies, drawing dies, Forming dies, Drawing operations, Determination of blank size, Drawing force, Single and Double action draw dies.

UNIT - V: DESIGN OF JIGS AND FIXTURES   (09 Periods)

Introduction, Concept of degrees of freedom, 3-2-1 principle of location, Principles of location and clamping for jig and fixtures design, Different types of locators and clamps, Jig bushes, Its types, Different types of jigs and its design, Essential features of different types of fixtures, Design of fixtures, Indexing jigs and fixtures, Automatic clamping devices.

Total periods: 45

TEXT BOOKS:

1. Donaldson, Lecain and Goold, *Tool Design*, Tata McGraw Hill, 4th edition, 2012.

2. A Bhattacharya, *Principles of Metal cutting*, New Central BookAgency, Calcutta, 2nd revised edition 2009.

REFERENCE BOOKS:

1. Surendra Kenav and Umesh Chandra, Satyaprakashan, *Production Engineering Design (Tool Design)*, New Delhi.

2. Amitabha Battacharya and Inyong Ham, *Design of Cutting Toolsuse of Metal Cutting Theory*, ASTME Publication, Michigan USA.

3. V.Arshinov, G.Alekseev, *Metal Cutting Theory and CuttingTool Design*, MIR Publications.

IV B. Tech. - I Semester
(16BT70308) COMPUTATIONAL FLUID DYNAMICS
(Program Elective-3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Heat Transfer.

COURSE DESCRIPTION: Introduction to Computational Fluid Dynamics(CFD); Various Numerical methods; Solution methods for governing equations; Finite difference method and its application to heat transfer problems; Errors and stability analysis; Study flow analysis; Simple CFD techniques.

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

CO1. Demonstrate the knowledge of CFD techniques, basic aspects of discretization and grid generation in solving partial differential equations.

CO2. Analyze CFD problems and offer probable solutions using Finite Differential approach.

CO3. Develop mathematical models and flow simulations for CFD problems.

CO4. Conduct investigations on complex CFD problems using different techniques.

CO5. Apply modern flow simulation codes for solving governing equations of computational fluid dynamics.

CO6. Use CFD techniques for critical decision making in various applications in the society to eliminate the need for expensive and complex prototypes.

DETAILED SYLLABUS:

UNIT – I: GOVERNING EQUATIONS   (09 Periods)

Introduction, applications of CFD in diverse fields, Governing equations of fluid dynamics – Continuity, Momentum and energy equations; Generic differential and integral form for governing equations, Initial and Boundary conditions, Differences between Finite element method, Finite difference method and Finite volume method, Classification of partial differential equations –

Hyperbolic, Parabolic, Elliptic and Mixed types; Applications and relevance.

UNIT – II: DISCRETIZATION TECHNIQUES   (09 Periods)

Basic Aspects of Discretization: Introduction to finite differences, Finite difference equations using Taylor series expansion and polynomials, Explicit and implicit approaches, Uniform and unequally spaced grid points.

Grids With Appropriate Transformation: General transformation of the equations, Metrics and Jacobians, The transformed governing equations of the CFD, Boundary fitted coordinate systems, Algebraic and elliptic grid generation techniques, Adaptive grids.

UNIT – III:FINITE DIFFERENCE FORMULATIONS (09 Periods)

Parabolic Partial Differential Equations: Finite difference formulations, Explicit methods – FTCS, Richardson and DuFort-Frankel methods, Implicit methods – Laasonen, Crank-Nicolson and Beta formulation methods, Approximate factorization, Fractional step methods, Consistency analysis, Linearization.

Stability Analysis: Discrete Perturbation Stability analysis, von Neumann Stability analysis, Error analysis, Modified equations, Artificial dissipation and dispersion.

UNIT – IV: ELLIPTIC AND HYPERBOLIC EQUATIONS
                                                (09 Periods)

Elliptic Equations: Finite difference formulation, solution algorithms: Jacobi-iteration method, Gauss-Siedel iteration method, point- and line-successive over-relaxation methods, alternative direction implicit methods.

Hyperbolic Equations: Explicit and implicit finite difference formulations, splitting methods, multi-step methods, applications to linear and nonlinear problems, linear damping, flux corrected transport, monotone and total variation diminishing schemes, tvd formulations, entropy condition, first-order and second-order TVD schemes.

UNIT – V: FINITE VOLUME METHOD   (09 Periods)

Introduction, Finding the flux at interface, Central schemes - Lax-Friedrichs Method, Lax-Wendroff Method, Two-Step Lax-

Wendroff Method and MacCormack Method; Upwind Method in Finite Volume methods - Flux Splitting Method Steger and Warming, Vanleer, Roe's Method and finding Roe's Averages; Numerical procedure for SIMPLE algorithm, Boundary conditions for the pressure correction method; Stream function, Vorticity method.

Total Periods: 45

TEXT BOOKS:

1. John. D. Anderson, *Computational Fluid Dynamics, the Basics with Applications*, Mc Graw Hill.6th Edition, 1995.

2. Hoffman, K.A., and Chiang, S.T., *Computational Fluid Dynamics*, Vol. I, II and III, Engineering Education System, Kansas, USA, 2000.

REFERENCE BOOKS:

1. Tapan K. Sengupta, *Fundamentals of Computational Fluid Dynamics*, 1st Edition, Universities Press, 2004.

2. Suhas V. Patankar, *Numerical Heat Transfer and Fluid Flow*, 1st Edition, CRC, 1980.

IV B. Tech. – I Semester
(16BT70309) INDUSTRIAL ROBOTICS
(Program Elective-3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Matrices and Numerical Methods and Dynamics of Machinery.

COURSE DESCRIPTION: Introduction of Robots classifications; Components; Robot drive mechanisms; Mechanical transmission methods aided in functioning of robots; Forward kinematics; inverse kinematics; Manipulator dynamics; Trajectory planning and avoidance of obstacles; Robot programming; Robot Application in Industry; Future Application and Challenges and Case Studies.

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

CO1. Demonstrate the knowledge on concepts of robot, Kinematics and dynamics, Trajectory planning and programming of robot.

CO2. Identify, analyze and interpret various methods and review the contemporary problems of robotics.

CO3. Optimize various robotic configuration parameters to analyze the reverse and forward kinematics.

CO4. Investigate the performance parameters on the complex robotic designs.

CO5. Apply appropriate functional techniques, resources, and programming tools to robotic engineering activities.

CO6. Consider safety issues in designing robots for societal applications.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION   (09 Periods)

Robot, Brief History, Classifications, Joint notation schemes, Work volume, Degrees of freedom, Components, End effectors - Classification of End effectors, Tools as end effectors; Drive system for grippers - Mechanical, Adhesive, Vacuum, Magnetic; Hooks & scoops, Gripper force analysis and gripper design, Active and Passive grippers.

UNIT - II: ROBOT DRIVES AND POWER TRANSMISSION SYSTEMS (08 Periods)

Robot Drive Mechanisms - Hydraulic, Electric-Servomotor, Stepper Motor; Pneumatic drives, Mechanical transmission method - Gear transmission, Belt drives; Cables, Roller chains, Link Rod systems, Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws.

UNIT - III: MANIPULATOR KINEMATICS & DYNAMICS (10 Periods)

Manipulator kinematics: Mathematical Preliminaries on Vectors & Matrices, Homogeneous transformations as applicable to rotation and translation, (D-H) notation, Forward kinematics, Inverse kinematics, Manipulators with two, Three degrees of freedom.

Manipulator dynamics: Introduction, Inertia of a Link, Lagrangian formulation for a planar 2R manipulator.

UNIT - IV: TRAJECTORY PLANNING & SENSORS (10 Periods)

Trajectory planning: Trajectory planning and avoidance of obstacles, Path planning, Skew motion, Joint integrated motion, straight line motion.

Sensors: Position sensors, Velocity sensors, Tactile sensors, Proximity sensors, Machine vision sensors, Fail safe hazard sensor systems and Compliance mechanism

UNIT - V: ROBOT PROGRAMMING AND APPLICATIONS (08 Periods)

Robot programming: Types, Features of languages and Software packages.

Robot application: Robot Application in Industry, Task programming, Goals of AI Research, AI Techniques, Robot Intelligence and Task Planning, Modern Robots, Future Application and Challenges, and Case Studies.

Total Periods: 45

TEXT BOOKS:

1. M.P.Groover, *Industrial Robotics: Technology, Programming, and Applications*, Tata McGraw-Hill, 2008.

2. John. J. Craig, *Introduction to Robotics: Mechanics and Control*, Pearson/Prentice Hall, 3rd Edition, 2005.

REFERENCE BOOKS:

1. Richard. D.Klafter, *Robotics Engineering: an integrated approach*, Prentice-Hall publisher, 1st Edition, 1988.

2. K. S. Fu., R. C. Gonzalez, C. S. G. Lee, *Robotics: Control Sensing*, Vision and Intelligence, International Edition, Tata McGraw Hill, 2008.

3. Ashitav Ghosal, *Robotics*, *Fundamental Concepts and Analysis*, Oxford Press, 2006.

4. Mittal R.K & Nagrath IJ, *Robotics and Control*, Tata McGraw Hill, 6th Edition, 2007.

IV B. Tech. — I Semester

(16BT70310) PRODUCT DESIGN

(Program Elective-3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Design of Machine Elements-I, CAD/CAM, Manufacturing Technology and Industrial Engineering and Management.

COURSE DESCRIPTION: Introduction to Design process; Identifying customer needs; Product development and design processes and methods; Product specifications; Concept development; Theory of Inventive Problem solving (TRIZ); Conception selection; Conception testing; Introduction to Embodiment design; Product architecture; Industrial design; Design for prototyping; and manufacturing; Ethical issues considered during Engineering Design Process.

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

CO1. Demonstrate the knowledge on general design principles, material selection, theories of failure, factor of safety and manufacturing considerations.

CO2. Analyze and interpret the given product by modeling and simulation techniques by using the design specifications.

CO3. Design the complex engineering models and solution for the product.

CO4. Investigate and improve the process by using the tools like Failure mode effect analysis and Taguchi Methods.

CO5. Consider societal and safety issues in the designing of the products.

CO6. Follow the Ethical principles during engineering design process.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION TO DESIGN   (08 Periods)

The design process, Morphology of Design, Design drawings, Computer Aided Engineering, Designing of standards, Concurrent Engineering, Product life cycle, Technological Forecasting,

Market Identification, Competition Bench marking, Systems Engineering, Life Cycle Engineering, Human Factors in Design, Industrial Design.

UNIT - II: DESIGN METHODS AND EVALUATION (10 Periods)

Creativity and Problem Solving, Product Design Specifications, Conceptual design - Pugti's chart, Decision theory, Theory of Inventive Problem solving; Embodiment Design - Detail Design, Evaluating Customer requirements and Bench marking, Quality Function Development; House of Quality (HOQ), Information sources, Copyright, Expert systems - Structural and Shape Optimization.

UNIT - III: EMBODIMENT DESIGN (10Periods)

Introduction to Product Architecture, Configuration and Parametric design Concepts, Industrial Design, Ergonomics and Design for Environment, Modeling and Simulation for engineering design process, Total Quality Concept - Quality Assurance, Statistics Process Control, Taguchi Methods; Robust Design, Failure Model Effect Analysis

UNIT - IV: MATERIAL SELECTION PROCESSING AND DESIGN (10periods)

Material selection Process, Economics - Cost Vs Performance; Weighted Property Index, Value Analysis, Role of Processing and Design, Classification of Manufacturing Process - Design for Manufacture, Design for Assembly, Design for castings, Forging, Metal Forming, Machining and Welding; Residual stresses - Fatigue, Fracture and Failure.

UNIT - V: TEAM WORK AND ETHICS IN ENGINEERING DESIGN (07 periods)

Team formation, functioning, discharge, team dynamics, Ethical issues considered during engineering design process, Project execution.

Total Periods: 45

TEXT BOOKS:

1. George E Dieter, Linda C. Schmidt, *Engineering Design*, McGraw Hill, 4th Edition, 2013.

2. Karl T Ulrich, Steven Eppinger, Anita Goyal, *Product Design Development*, McGraw Hill, 4th Edition, 2009.

REFERENCE BOOKS:

1. A. K. Chitale; R.C. Gupta, *Product Design and Manufacturing*, Prentice - Hall India, 5th Edition, 2011.

2. Dieter Kevin Otto and Kristin Wood, *Product Design: Techniques in Reverse Engineering and New Product Development*, Pearson Education Inc, 1st Edition, 2003.

IV B. Tech. - I Semester
(16BT70311) PRODUCTION AND OPERATIONS MANAGEMENT
(Program Elective-3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Industrial Engineering and Management.

COURSE DESCRIPTION: Overview of production and operations management concepts and issues from both strategic and operational perspective; relationships between operations and environment; analysis of strategic issues relating to competitiveness in production and operations management, and application of tools to improve productivity in production and operations; concepts/principles related to management of operations – forecasting demand; production, material and capacity requirements planning; scheduling; inventory planning and control; lean and supply chain management systems.

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

CO1. Demonstrate the knowledge of Aggregate Planning, Scheduling, Forecasting, and Supply Chain Management to various operations of industry.

CO2. Analyze the operations of an industry and incorporate principles and concepts of operations management to asses and improve operational performance.

CO3. Design a process by optimizing the use of resources that meet the specified needs with appropriate consideration for industrial operations.

CO4. Apply the techniques of forecasting, aggregate planning, Just-In-Time, Enterprise Resource Planning, Kaizen to establish methods for maximizing productivity.

CO5. Use the concepts of operations management and specialized knowledge in Operations Management to solve business processes steering to meet societal needs.

CO6. Manage the industrial projects from forecasting of demand, identification of Material requirements, scheduling on machines and dispatching it to customer

DETAILED SYLLABUS:

UNIT - I: OPERATIONS MANAGEMENT CONCEPTS
(09 Periods)

Introduction, Historical development, Information and Nonmanufacturing systems, Operations management, Factors affecting productivity, International dimensions of productivity, environment of operations, Production systems decisions.

UNIT - II: FORECASTING DEMAND   **(09 Periods)**

Forecasting: objectives and uses, Forecasting variables, Opinion and judgmental methods, Time Series Methods: Moving Average Method, Weighted Moving Average Method, Exponential smoothing, Regression and correlation methods; Application and control of forecasts.

UNIT - III: AGGREGATE PRODUCTION PLANNING
(09 Periods)

Planning hierarchies in operations, Need for aggregate production Planning, Alternatives for managing supply and demand, Basic strategies for aggregate production planning - level, Chase and mixed, Aggregate Production Planning Methods, Master production scheduling. Introduction to aggregate capacity planning.

UNIT - IV: MATERIAL REQUIREMENTS PLANNING & LEAN SYSTEMS   **(09 Periods)**

MRP-underlying concepts, Bill of Material, System parameters, MRP logic, System refinements. Manufacturing Resource Planning, Enterprise Resource Planning. Just-in-Time, Pull method of materials flow, Consistently high quality, Small lot sizes, Uniform workstation loads, Standardized components and work methods, Close supplier ties, Flexible workforce, Line flows, Automated production, Preventive maintenance, continuous improvement, Kaizen.

UNIT - V: MACHINE SCHEDULING & SUPPLY CHAIN MANAGEMENT   **(09 Periods)**

Flow shop scheduling- Introduction, Johnson's rule for 'n' jobs on 2 and 3 machines, CDS heuristic, Palmer's Heuristic; Job scheduling- Types of schedules, Heuristic procedure, scheduling 2 jobs on 'm' machines, Supply chain components, Supply chain structures, Bullwhip effect, Role of information technology in Supply Chain Management.

Total Periods: 45

TEXT BOOKS:

1. B.Mahadevan, *Operations Management*, Pearson education, 2nd edition, 2010.

2. Everett E. Adams and Ronald J. Ebert, *Production and Operations Management*, PHI Learning, 5th edition, 2009.

3. Lee J Krajewski, Larry P Ritzman and M K Malhotra, *Operations Management – Processes and Value Chains*, 8th edition, 2008.

REFERENCE BOOKS:

1. S N Chary, *Production and Operations Management*, Tata-McGraw-Hill education (India), Pvt limited, 2013.

2. Monks J.G., *Operations Management*, Schaums outline series, McGraw-Hill International Edition, 5th edition, 1996.

3. R Pannerselvam, *Production and Operations Management*, PHI learning, 2nd edition, 2009.

IV B. Tech. – I Semester
(16BT70312) POWER PLANT ENGINEERING
(Program Elective-4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Thermal Engineering-II and Heat transfer.

COURSE DESCRIPTION: Energy sources; Types of Power Plants; Thermal power plant; Study of various systems of thermal power plant; Combustion and Firing Methods; Diesel Power plant; Gas Turbine Power Plants; Hydroelectric power plants and Nuclear power plants; Power generation and recovery systems; Various conventional and nonconventional sources of energy with power plant economics.

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

CO1. Demonstrate the knowledge on various power plants and its sub systems.

CO2. Identify, analyze and formulate the various systems and components in power plants.

CO3. Propose probable designs of power plants for a particular geographic region.

CO4. Conduct investigation on the components of power plants using thermodynamic analysis to predict the performance of the power plants.

CO5. Consider health and safety issues in selecting a suitable type of power plant in a given location.

CO6. Provide preliminary estimates of the capital cost and operating costs of a power plant.

DETAILED SYLLABUS:

UNIT - I: THERMAL POWER PLANT   (09 Periods)

Introduction to the sources of energy, Plant layout, selection of site for power plant, Coal handling systems, Overfeed and underfeed stoker principles, Traveling grate stokers, Spreader stokers, Multi retort stokers, Pulverized fuel firing - Pulverized fuel handling, Pulverizing mills, Pulverized fuel burners; Ash handling systems, Dust collectors.

UNIT - II: DIESEL ENGINE AND GAS TURBINE POWER PLANTS
(07 periods)

Diesel Power Plant: Essential components of diesel power plant, Operation of diesel power plant, Plant layout with auxiliaries.

Gas Turbine Plant: Requirements, Functions, Classification, Construction, and Layout with auxiliaries.

UNIT - III: HYDRO ELECTRIC AND NUCLEAR POWER PLANTS
(11 periods)

Hydro Electric Power Plant: Selection of site for power plant, Typical layouts, Elements of plant, Classification of dams, Spill ways, Surge tank, Draft tube, Classification of Hydroelectric power plants, Hydrology, Hydrological cycle, Hydrographs; **Nuclear Power Plants:** Requirements, Functions, 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.

UNIT - IV: NON CONVENTIONAL POWER GENERATION AND DIRECT ENERGY CONVERSION SYSTEMS   (09 Periods)

Non-Conventional Power Generation: Solar, Wind, Tidal, Ocean energy conversion, Geothermal, and biogas power plants.

Direct energy conversion systems: Thermoelectric conversion system, Thermionic conversion system, Photovoltaic power systems, Magneto Hydrodynamic systems, Electrostatic mechanical generators, Electro gas-dynamic generators, and Fuel cells.

UNIT - V: POWER PLANT ECONOMICS AND POLLUTIONS
(09 Periods)

Load curves, Load duration curve, Definitions of connected load, Maximum demand, Demand factor, Load factor, Plant capacity factor, Plant use factor, Diversity factor, Cost Analysis, Power plant pollution- Pollutions from Thermal and Nuclear Power plants.

Total Periods: 45

SVEC16 - B.TECH - MECHANICAL ENGINEERING

TEXT BOOKS:

1. R.K.Rajput, *A Text Book of Power Plant Engineering*, Laxmi Publications, 3rd edition, 2014.

2. Arora and S. Domkundwar, *A Course in Power Plant Engineering*, Dhanpat Rai and Co, 3rd Edition, 2012.

REFERENCE BOOKS:

1. P.K.Nag, *Power Plant Engineering*, TMH, 2nd edition, 2006.

2. K.K Ramalingam, *Power Plant Engineering*, Scitech Publishers, 2nd edition, 2010.

3. Dr.P.C Sharma, *Power Plant Engineering*, Sk Kataria and sons publishers, 8th Edition, 2011.

IV B. Tech – I Semester
(16BT70313) PROJECT MANAGEMENT
(Program Elective-4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Course on Industrial Engineering and Management.

COURSE DESCRIPTION: Project Characteristics; Project Selection; Economics; Feasibility Assessment and Evaluation; Project integration; Project scope management; Project time and cost management; Organizational and Work Breakdown; Scheduling; Budgeting; Project Control; Project Auditing; Financing for projects; Project investment evaluation.

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

CO1. Demonstrate the process of project management and practice it in the execution of projects.

CO2. Analyze the key performance metrics, audit report and project closure activities to obtain formal project acceptance.

CO3. Develop the resources required for a project to produce effective work plan and resource schedule.

CO4. Apply project management tools and techniques for project communications, risk analysis, and quality control.

CO5. Steer the projects for maximizing societal benefit.

CO6. Provide accurate project cost estimates and to plan various activities accordingly.

DETAILED SYLLABUS:

UNIT –I: PROJECT SELECTION AND PLANNING (09 Periods)

Project identification and formulation; Needs analysis - Resource surveys, Market research; Identification of investment opportunities; Feasibility analysis - Technical feasibility; Technology forecasting - Choice of technology, Techno economic analysis, Appropriate technology; Project environment - Nature,

and Characteristics of projects; Projects screening - Project selection, Project portfolio process; Project life cycle; Work content - Work breakdown structure, Time Estimation Method; Systems integration; Interface coordination; Social Cost Benefit Analysis.

UNIT —II: PROJECT IMPLEMENTATION (09 Periods)

Estimating Project Budgets; Process of cost estimation; Project Scheduling tools; Developing Project Plan (Baseline); Project cash flow analysis; Project scheduling with resource constraints - Resource Leveling and Resource Allocation; Project Execution and Administration; Project contracting - Contract pricing, Project time monitoring and Cost monitoring, Project over run.

UNIT —III: MONITORING AND INFORMATION SYSTEMS

(09 Periods)

Information needs and the reporting process; Computerized project management information system; Earned value analysis; Planning-Monitoring-Controlling cycle; Project control - Types of control processes, Design of control systems, Control of change and scope.

UNIT —IV: PROJECT APPRAISAL AND PROJECT AUDITING
(09 Periods)

Project Appraisal - Objectives, Essentials of a project methodology, Market appraisal, Technical appraisal, Financial appraisal, Socio-economic appraisal, Management appraisal; Post-Project analysis - Construction and use of audit report, Project audit life cycle, Essentials of audit and evaluation, Varieties of project termination, The termination process.

UNIT —V: PROJECT FINANCING (09 Periods)

Rationale of Project Financing; Essential elements of project financing; Analysis of project viability and risk management; Ownership and Financial Structuring; Legal Documentation; Investment evaluation using capital budgeting techniques - Net present value, Payback period, Discounted cash flow, Internal rate of return.

Total Periods: 45

TEXT BOOKS:

1. Prasanna Chandra, *Projects: Planning, Analysis, Selection, Financing, Implementation and Review*, McGraw Hill Education (India) Private Limited, 8th edition, 2014.

2. Jack R. Meredith, and Samuel J. Mantel Jr., *Project Management – A Managerial Approach*, Wiley India Pvt. Ltd., New Delhi, 8th Edition, 2012.

REFERENCE BOOKS:

1. Harold Kerzner, *Project Management – A Systems Approach to Planning, Scheduling and Controlling*, Wiley India Pvt. Ltd., 10th Edition, 2013.

2. Larry Richman, *Project Management: Step-by-Step*, PHI Learning Private Limited, 2011.

IV B. Tech. – I Semester
(16BT70314) RAPID PROTOTYPE TECHNOLOGY
(Program Elective-4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on CAD/CAM and Manufacturing Technology.

COURSE DESCRIPTION: History of RP systems; Stereo; Data files and machine details; Type of machines; Solid Ground Curing; Principle of operation, Machine details; Applications; Thermal jet printer; 3-D printer; GenisysXs printer HP system 5; Indirect Rapid tooling, Silicone rubber tooling; Aluminum filled epoxy tooling; Tooling; Quick cast process; Copper polyamide; Rapid Tool; DMILS; Software For RP; STL files; Overview of Solid view; Collaboration tools; Rapid manufacturing process optimization; Vacuum; Casting, Surface digitizing; data transfer to solid models.

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

CO1. Demonstrate the knowledge to identify the tools needed to produce a prototype of the product using RPT techniques.

CO2. Analyze the various simulations /proto typings and select an RPT system.

CO3. Develop the steps to acquire the desired products in any RPT system using the knowledge of process parameters of the machine.

CO4. Investigate the viability of various rapid tooling for specific applications.

CO5. Apply tools to develop manufacturing data which will be essential to produce products conforming to industrial standards.

DETAILED SYLLABUS:

UNIT – I: FUNDAMENTALS OF RAPID PROTOTYPING
                                                                       (09 Periods)

Definition, Types of prototypes, Classification of RP Systems, Need for the compression in product Development, History of RP systems, Applications survey, Development of RP industry.

UNIT - II: STEREO LITHOGRAPHY SYSTEMS (09 Periods)

Principle; Process parameters; Process details; Data preparation; Data files and machine details; Application.

Selective laser sintering: Machine types, Operating principle, Process parameters, Data preparation for SLS, Applications, and Fusion deposition modeling: Principle, Process parameters, Path generation, Applications.

UNIT - III: SOLID GROUND CURING   (09 Periods)

Principle, Machine details, Applications, Laminated Object Manufacturing: Principle, LOM materials, Process details, Application.

Concepts modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer, GenisysXs printer HP system – 5, Object Quadra systems.

UNIT - IV: RAPID TOOLING   (09 Periods)

Indirect Rapid tooling, Silicon rubber tolling, Aluminium filled epoxy tooling, Spray metal tooling, Cast kirksite, 3D Keltool, Direct Rapid Tooling - Direct, AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling- soft Tooling and Hard tooling.

UNIT - V: SOFTWARE FOR RAPID PROTOTYPING (09 Periods)

STL files, Overview of Solid view, Magics, Magic communicator, Internet based software, Collaboration tools, Rapid Manufacturing Process Optimization - Factors influencing accuracy, Data preparation errors, Part building errors, Error in finishing, Influence of build orientation.

Allied processes: Vacuum casting, Surface digitizing, Surface generation from point cloud, Surface modification, Data transfer to solid models.

Total Periods: 45

TEXT BOOKS:

1.   Paul F. Jacobs, *Stereo lithography and other RP and M Technologies*, SME, New York, 3rd edition, 1996.

2.   Frank W. Liou, *Rapid Prototyping and Engineering Applications*, CRC Press Taylor and Francis Group, New York, Special Indian Edition, 2011.

REFERENCE BOOKS:

1. C. K. Chua, K. F. Leong, C. S. Lim, *Rapid Prototyping - Principles and Applications*, Yesdee publications Pvt. Ltd., Mumbai, India, 2nd edition, 2010.

2. Hari Prasad, K.S. Badarinarayan, *Rapid Prototyping and Tooling*, SIP PageTuners, Bangalore, 1st Edition, 2013.

3. Fiham D.T, Dinjoy S. S, *Rapid Manufacturing*, Verlog, London, 4th edition, 2002.

IV B. Tech. - I Semester
(16BT70315) **TRIBOLOGY**
(Program Elective-4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Fluid Mechanics and Design of Machine Elements-II.

COURSE DESCRIPTION: Surface friction; characteristic, sources, wear of various metals; lubricants, types, lubrication necessity; film lubrication theory; loads on bearing; surface modification; surface coatings; fusion processes; material for bearings.

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

CO1. Demonstrate the knowledge on effect of friction, wear phenomenon and lubrication in any system of mechanism.

CO2. Analyze complex problems in tribological system of mechanical engineering.

CO3. Design the journal bearing and provide suitable lubrication to minimize the stresses.

CO4. Conduct investigations on complex problems tribology and provide valid Solutions

CO5. Deploy the contextual knowledge on friction/lubrication mechanisms to the professional Engineering practices.

CO6. Implement the design pattern to have eco-friendly environment and sustainable development.

DETAILED SYLLABUS:

UNIT - I: SURFACES AND FRICTION   (09 Periods)

Topography of Engineering surfaces, Contact between surfaces, Sources of sliding Friction, Adhesion Ploughing - Energy dissipation mechanisms; Friction Characteristics of metals, Friction of non metals, Friction of lamellar solids, friction of Ceramic materials and polymers, Rolling Friction, Source of Rolling Friction, Stick slip motion, Measurement of Friction.

UNIT - II: WEAR (09 Periods)

Types of wear, Simple theory of Sliding Wear, Mechanism of sliding wear of metals, Abrasive wear, Materials for Adhesive, Abrasive wear situations, Corrosive wear, Surface Fatigue wear situations, Brittle Fracture wear, Wear of Ceramics and Polymers, Wear Measurements.

UNIT - III: LUBRICANTS AND LUBRICATION TYPES

(09 Periods)

Lubrication types, properties, Requirements of Lubricants, Testing methods, Hydrodynamic Lubrication, Elasto-hydrodynamic lubrication, Boundary Lubrication, Mist lubrication, Necessity of lubrication, Solid Lubrication, Hydrostatic Lubrication.

UNIT - IV: FILM LUBRICATION THEORY (09 Periods)

Fluid film in simple shear, Viscous flow between very close parallel plates, Shear stress variation, Reynolds Equation for film Lubrication, High speed unloaded journal bearings, Loaded journal bearings, Reaction torque on the bearings, Virtual Co-efficient of friction, The Somerfield diagram.

UNIT - V: SURFACE ENGINEERING AND BEARING MATERIALS
(09 Periods)

Surface modifications, Transformation Hardening, Surface fusion, Thermo chemical processes, Surface coatings, Plating and anodizing, Fusion Processes, Vapour Phase processes, Materials for rolling Element bearings, Materials for fluid film bearings, Materials for marginally lubricated and dry bearings.

Total no. of periods: 45

TEXT BOOKS:

1. I.M. Hutchings, Tribology, Friction and Wear of Engineering Material, Edward Arnold, London, 1992.

2. A.Harnoy, *Bearing Design in Machinery*, Marcel Dekker Inc, New York, 2003

REFERENCE BOOKS:

1. Kenneth C Ludema, *Friction, Wear, Lubrication: A Textbook in Tribology*, CRC Press,1996.

2. A.Cameron, *Basic Lubrication Theory*, Longman, U.K.., 1981.

3. M.J.Neale (Editor), *Tribology Handbook* , Newnes. Butter worth, Heinemann, U.K.,1995.

4. T.A. Stolarski, *Tribology in Machine Design*, Industrial Press Inc., 1990.

IV B. Tech. - I Semester
(16BT70331) COMPUTER AIDED MANUFACTURING AND AUTOMATION LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: --

COURSE DESCRIPTION: CNC Programming; Pressure control valve; flow control valve; Directional control valve; Logic controls; Timers; PLC; Ladder diagram; Robotics.

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

CO1. Demonstrate the practical usage of automation and robotics.

CO2. Analyse the hydraulic, pneumatic circuits for the appropriateness to real time applications.

CO3. Design and model different components using automation and develop codes for part programming in CNC

CO4. Conduct investigations to suit the automation and robotics for practical applications.

CO5. Using computer numerical control techniques in computer aided manufacturing of components.

CO6. Formulate the team to attain multidisciplinary settings in achieving automation.

CO7. Communicate effectively on sequence of manufacturing operations for the given component or machine.

Any TWELVE Experiments Should Be Coducted and Six Experiments in Each section.

LIST OF EXPERIMENTS:

CAM:

1. Exercise in Basic manual part program and simulation practice in CNC TURN

    a) Step turning.

    b) Step turning and Taper turning, Profile turning.

2. Exercise in manual part program using canned cycle and simulation practice in CNC TURN

    a) Step turning using canned cycle.

    b) Grooving using canned cycle.

    c) Thread cutting using canned cycle.

    d) Drilling using canned cycle.

3. Exercise in Basic manual part program and simulation practice in CNC MILL

    a) Profile Milling.

    b) Circular pocket milling.

    c) Rectangular pocket milling.

4. Component making practice in CNC TURN

    a) Step turning.

5. Component making practice in CNC TURN

    a) Step turning and Taper turning, Profile turning.

6. Component making practice in CNC TURN

    a) Thread cutting using canned cycle.

7.   Component making practice in CNC Mill

    a) Profile Milling.

8. Component making practice in CNC Mill

    a) Rectangular pocket milling

9. Die Making practice using CNC Mill

AUTOMATION:

1. Design and testing of hydraulic circuits for Single acting cylinder using pressure control   Valves, flow control valves, DCVs (Mechanical, Pilot, Solenoid)

2. Design and testing of hydraulic circuits for double acting cylinder using pressure control   Valves, flow control valves, DCVs (Mechanical, Pilot, Solenoid)

3. Design and testing of hydraulic circuits for single/double acting cylinder using Gate valves Pressure control   valves, flow control valves, DCVs(Mechanical, Pilot, Solenoid)

4. Design of circuit with programmed logic sequence, using PLC in hydraulic Electro hydraulic Trainer

5. Programming of PLC using ladder logic diagram

6. Circuits with multiple cylinder sequences in Electro pneumatic Trainer using PLC

7. Simulation of basic hydraulic, pneumatic and electrical circuits using Automation studio Soft ware.

8. Modeling and analysis of basic electrical, hydraulic, and pneumatic systems using MATLAB/LABVIEW software

9. Programming exercise for robot

IV B. Tech. - I Semester

(16BT70332) INDUSTRIAL ENGINEERING LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Course on Operations Research.

COURSE DESCRIPTION: Work study; Method Study; Preparation of Process Charts; Work Measurement; Time Study; Productivity; Sampling; Quality control for attributes; Ergonomics; Supply Chain Management, Simulation of Inventory.

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

CO1. Demonstrate the concepts and use of IE techniques in providing solutions to complex productivity related Problems.

CO2. Analyze the process parameters required for conducting the experiments related to industrial engineering problems.

CO3. Prepare (Design) and conduct the exercises on Process chart, Method study and Work Measurement for effective utilization of Man- power resources.

CO4. Investigate the results obtained in the various experiments anovide suitable conclusions.

CO5. Apply IE techniques to achieve Effective work place environment.

CO6. Work and contribute to team to accomplish common goals.

CO7. Communicate effectively about laboratory work reports and presentation.

Any TWELVE Experiments Should Be Coducted

LIST OF EXPERIMENTS

1. Preparation of Process Charts for Method Study

2. String diagram

3. Work Measurement - Time study by Stop watch

4. Bolt & Nut assembly, Productivity enhancement experiment

5. Hand-tool dexterity test –Fatigue Mesurment

6. Minnesota dexterity test

7. Pyramid Puzzle Burmese test

8. O'Connor Finger Dexterity Test

9. Purdue Peg Board test

10. Simple Assembly Process experiment

11. Segregation/Sorting test using different size bolts, washers (rubber & metal), nuts, screws with one hand and with both hands

12. Jebsen Taylor Hand function test

13. Study of Control charts for variables

14. Quality Control of Attributes - Sampling experiments

15. Bull-whip effect /Beer Game/

IV B. Tech – I Semester
(16BT70333) COMPREHENSIVE ASSESSMENT

Int. Marks **Ext. Marks** **Total Marks** **L** **T** **P** **C**
-　　　　100　　　　100　　　-　-　-　2

PRE-REQUISITES: All the courses of the program.

COURSE DESCRIPTION: Assessment of student learning outcomes in the courses of the program.

COURSE OUTCOMES: Comprehensive Assessment enables a successful student to demonstrate:

CO1.　Knowledge in the courses of the program.

CO2.　Analytical ability in the courses of the program.

CO3.　Design skills in the courses of the program.

CO4.　Ability to investigate and solve complex engineering problems in the courses of the program.

CO5.　Ability to apply tools and techniques to complex engineering activities with an understanding of limitations in the courses of the program.

CO6.　Ability to provide solutions as per societal needs with consideration to health, safety, legal and cultural issues in the courses of the program.

CO7.　Understanding of the impact of the professional engineering solutions in environmental context and need for sustainable development in the courses of the program.

CO8.　Ability to apply ethics and norms of the engineering practice in the courses of the program.

CO9.　Ability to function effectively as an individual in the courses of the program.

CO10. Ability to present views cogently and precisely in the courses of the program.

CO11. Ability to engage in life-long leaning in the courses of the program.

IV B. Tech – II Semester
(16BT80331) PROJECT WORK

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
100	100	200	-	-	-	12

PRE-REQUISITES: All the courses of the program.

COURSE DESCRIPTION: Identification of topic for the project work; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the project work; Preparation of thesis and presentation.

COURSE OUTCOMES: Completion of the project work enables a successful student to demonstrate:

CO1. Knowledge on the project topic.

CO2. Analytical ability exercised in the project work.

CO3. Design skills applied on the project topic.

CO4. Ability to investigate and solve complex engineering problems faced during the project work.

CO5. Ability to apply tools and techniques to complex engineering activities with an understanding of limitations in the project work.

CO6. Ability to provide solutions as per societal needs with consideration to health, safety, legal and cultural issues considered in the project work.

CO7. Understanding of the impact of the professional engineering solutions in environmental context and need for sustainable development experienced during the project work.

CO8. Ability to apply ethics and norms of the engineering practice as applied in the project work.

CO9. Ability to function effectively as an individual as experienced during the project work.

CO10. Ability to present views cogently and precisely on the project work.

CO11. Project management skills as applied in the project work.

CO12. Ability to engage in life-long leaning as experience during the project work.

SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
Sree Sainath Nagar, A.Rangampet, Near Tirupati - 517 102. A.P.

Salient Features of Prohibition of Ragging in Educational Institutions Act 26 of 1997

- Ragging within or outside the College is prohibited.

- Ragging means doing an act which causes or is likely to cause insult or annoyance or fear or apprehension or threat or intimidation or outrage of modesty or injury to a student

Nature of Ragging	Punishment
Teasing, Embarrassing and humiliating	Imprisonment up to 6 months or fine up to Rs. 1,000/- or Both
Assaulting or using criminal force or criminal intimidation	Imprisonment up to 1 year or fine up to Rs. 2,000/- or Both
Wrongfully restraining or confining or causing hurt	Imprisonment up to 2 years or fine up to Rs. 5,000/- or Both
Causing grievous hurt, Kidnapping or rape or committing unnatural offence	Imprisonment up to 5 years or fine up to Rs. 10,000/-
Causing death or abetting suicide	Imprisonment up to 10 years or fine up to Rs. 50,000/-

Note:

1. A student convicted of any of the above offences, will be expelled from the College.

2. A student imprisoned for more than six months for any of the above offences will not be admitted in any other College.

3. A student against whom there is prima facie evidence of ragging in any form will be suspended from the College immediately.

4. The full text of Act 26 of 1997 **and** UGC Regulations on Curbing the Menace of Ragging in Higher Educational Institutions, 2009 **(Dated 17th June, 2009) are placed in the College library for reference.**