



SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution under UGC, New Delhi)

**(Permanently Affiliated to JNTUH, Approved by AICTE, New Delhi and Accredited by NBA, NAAC)
Sheriguda Village, Ibrahimpatnam Mandal, Ranga Reddy Dist. – 501 510**

BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING

CHOICE BASED CREDIT SYSTEM (CBCS)

**ACADEMIC REGULATIONS, COURSE STRUCTURE AND SYLLABI FOR
I TO IV YEARS – I & II SEMESTERS
UNDER AUTONOMOUS STATUS FOR THE BATCHES ADMITTED FROM
THE ACADEMIC YEAR 2022 – 23**

**B.Tech. Regular Four Year Degree Programme
(For the batches admitted from the academic year 2022–23)**

&

**B.Tech. (Lateral Entry Scheme)
(For the batches admitted from the academic year 2023 - 24)**

Note: The regulations here under are subject to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already undergoing the program) as may be decided by the Academic Council.



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Vision of the Institute

**To be a Premier Institution in Engineering
& Technology and Management for
Competency, Values and Social
Consciousness**

Mission of the Institute

- IM₁: Provide high quality academic programs, training activities and research facilities.**
- IM₂: Promote continuous industry – institute interaction for Employability, entrepreneurship, leadership and research aptitude among stakeholders**
- IM₃: Contribute to the economical and technological development of the region, state and Nation.**



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Vision of the Department

To be a centre of excellence in the field of Mechanical Engineering with professional and ethical responsibilities.

Mission of the Department

- DM₁:** To provide value added education in Mechanical and allied engineering.
- DM₂:** To provide conducive environment oriented towards innovation.
- DM₃:** To impart training on emerging technologies like CAD/CAM with involvement of stake holders.
- DM₄:** Inculcating ethical values ability towards lifelong learning and social responsibilities.

PROGRAM OUTCOMES (POs):

PO1	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES(PSOs):

PSO1	Basic Mechanical knowledge: Apply basic knowledge related to Mechanical Design, Manufacturing, Thermal Engineering and CAD/CAM to solve various engineering/societal problems.
PSO2	Design methods: Design, verify, Fabricate and suitable Mechanical functional elements for different applications, with skills to interpret and communicate results.
PSO3	Experimentation and Analysis: Engineering and management concepts are used to analyze specifications and prototype Mechanical experiments/projects either independently or in groups.

Program Educational Objectives (PEOs):

PEO1	Higher Degree and Professional Employment: Graduates with ability to attract core industries and pursue higher studies in reputed institutions.
PEO2	Domain Knowledge: Graduates with a solid foundation in basic sciences and Mechanical Engineering.
PEO3	Engineering Career: Graduates with effective communication skills, teamwork, multidisciplinary approach to provide professional environment.
PEO4	Life Long Learning: Graduates with excellence, leadership and lifelong learning for successful career.



SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution under UGC, New Delhi)

ACADEMIC REGULATIONS 2022 (BR22) FOR CHOICE BASED CREDIT SYSTEM (CBCS) B.TECH. DEGREE COURSES

(Applicable for Students admitted from the academic year 2022-2023)

PRELIMINARY DEFINITIONS AND NOMENCLATURES

- “Autonomous Institute / College” means an institute / college designated as autonomous institute / college by the UGC, New Delhi and JNTUH Statutes, 2014.
- “Academic Autonomy” means freedom to a College in all aspects of conducting its academic programs granted by the University for promoting excellence.
- “Commission” means University Grants Commission (UGC), New Delhi.
- “AICTE” means All India Council for Technical Education.
- “University” means the Jawaharlal Nehru Technological University, Hyderabad.
- “College” means SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY, Hyderabad unless indicated otherwise by the context.
- “Programme” means: Bachelor of Technology (B.Tech) degree programme
- “Branch” means specialization in a programme like B.Tech degree programme in Electronics and Communication Engineering, B.Tech degree programme in Computer Science and Engineering etc
- “Course” or “Subject” means a theory or practical subject, identified by its course – number and course-title, which is normally studied in a semester. For example, R22MTH1111: Matrices and Calculus, R22MED2212: Kinematics of Machinery etc.
- T – Tutorial, P – Practical, D – Drawing, L - Theory, C – Credits



SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution under UGC, New Delhi)

ACADEMIC REGULATIONS 2022 (BR22) FOR CHOICE BASED CREDIT SYSTEM (CBCS) B.TECH. DEGREE COURSES

(Applicable for Students admitted from the academic year 2022-2022)

1.0 Under-Graduate Degree Programme in Engineering & Technology (UGP in E&T)

Sri Indu College of Engineering & Technology (SICET) offers a 4-year (8 semesters) Bachelor of Technology (B.Tech.) degree programme, under Choice Based Credit System (CBCS) with effect from the academic year 2022-23.

1.1 Courses of study

The following courses of study (Branches) are offered at present by the college with specialization in the B. Tech. Course:

Sl. No.	Branch Code	Branch
1	1	CIVIL ENGINEERING
2	2	ELECTRICAL & ELECTRONICS ENGINEERING
3	3	MECHANICAL ENGINEERING
4	4	ELECTRONICS & COMMUNICATION ENGINEERING
5	5	COMPUTER SCIENCE & ENGINEERING
6	12	INFORMATION TECHNOLOGY
7.	33	COMPUTER SCIENCE AND INFORMATION TECHNOLOGY
8.	67	CSE (DATA SCIENCE)
9.	66	CSE (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)
10.	62	CSE (CYBER SECURITY)
11.	69	CSE – (INTERNET OF THINGS (IoT))
12.	72	ARTIFICIAL INTELLIGENCE & DATA SCIENCE

2.0 Eligibility for Admission

2.1 Admission to the undergraduate(UG) programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test conducted by the Telangana State Government (EAMCET) or the University or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the government from time to time.

2.2 The medium of instructions for the entire undergraduate programme in Engineering & Technology will be English only.

3.0 B.Tech Program Structure

- 3.1** A student after securing admission shall complete the B.Tech. programme in a minimum period of four academic years (8 semesters), and a maximum period of eight academic years (16 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech course. Each student shall secure 160 credits (with CGPA \geq 5) required for the completion of the undergraduate programme and award of the B.Tech. degree.
- 3.2** UGC/ AICTE specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms, which are listed below.

3.2.1 Semester Scheme

Each undergraduate programme is of 4 academic years (8 semesters) with the academic year divided into two semesters of 22 weeks (\square 90 instructional days) each and in each semester - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)' under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) indicated by UGC, and curriculum/course structure suggested by AICTE are followed.

3.2.2 Credit Courses

All subjects/ courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (Lecture Periods: Tutorial Periods: Practical Periods: Credits) structure based on the following general pattern.

- One credit for one hour/ week/ semester for theory/ lecture (L) courses or Tutorials.
- One credit for two hours/ week/ semester for laboratory/ practical (P) courses.

Courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab are mandatory courses. These courses will not carry any credits.

3.2.3 Subject Course Classification

All subjects/ courses offered for the undergraduate programme in E&T (B.Tech. degree programmes) are broadly classified as follows. The College has followed almost all the guidelines issued by AICTE/UGC.

S.	Broad Course	Course Group/	Course Description
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No.	Classification	Category	
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes mathematics, physics and chemistry subjects
2		ES - Engineering Sciences	Includes fundamental engineering subjects
3		HS – Humanities and Social sciences	Includes subjects related to humanities, social sciences and management
4	Core Courses (CoC)	PC – Professional Core	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
5	Elective Courses (ElC)	PE – Professional Electives	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
6		OE – Open Electives	Elective subjects which include inter- disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering.
7	Core Courses	Project Work	B.Tech. project or UG project or UG major project or Project Stage I & II
8		Industry Training/ Internship/ Industry Oriented Mini- project/ Mini-Project/ Skill Development Courses	Industry Training/ Internship/ Industry Oriented Mini-Project/ Mini-Project/ Skill Development Courses
9		Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
10	Minor courses	-	1 or 2 Credit courses (subset of HS)
11	Mandatory Courses (MC)	-	Mandatory courses (non-credit)

4.0 Course Registration

- 4.1 A 'faculty advisor or counselor' shall be assigned to a group of 20 students, who will advise the students about the undergraduate programme, its course structure and curriculum, choice/option for subjects/ courses, based on their competence, progress, pre- requisites and interest.
- 4.2 The academic section of the college invites 'registration forms' from students before the beginning of the semester through 'on-line registration', ensuring 'date and time stamping'. The on-line registration requests for any 'current semester' shall be **completed before the commencement of SEEs (Semester End Examinations) of the 'preceding semester'**.
- 4.3 A student can apply for **on-line** registration, **only after** obtaining the '**written approval**' from faculty advisor/counselor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with the Head of the Department, Faculty Advisor/ Counselor and the student.
- 4.4 A student may be permitted to register for all the subjects/ courses in a semester as specified in the course structure with maximum additional subject(s)/course(s) limited to 6 Credits (any 2 elective subjects), based on **progress** and SGPA/ CGPA, and completion of the '**pre-requisites**' as indicated for various subjects/ courses, in the department course structure and syllabus contents.
- 4.5 Choice for '**additional subjects/ courses**', not more than any 2 elective subjects in any Semester, must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/Mentor/HOD.
- 4.6 If the student submits ambiguous choices or multiple options or erroneous entries during on-line registration for the subject(s) / course(s) under a given/ specified course group/ category as listed in the course structure, only the first mentioned subject/ course in that category will be taken into consideration.
- 4.7 Subject/ course options exercised through **on-line** registration are final and **cannot** be changed or inter-changed; further, alternate choices also will not be considered. However, if the subject/ course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any inevitable or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within **a week** after the commencement of class-work for that semester.
- 4.8 Dropping of subjects/ courses may be permitted, only after obtaining prior approval from the faculty advisor/ counselor 'within a period of 15 days' from the beginning of the current semester.
- 4.9 **Open Electives:** The students have to choose three Open Electives (OE-I, II &

III) from the list of Open Electives given by other departments. However, the student can opt for an Open Elective subject offered by his own (parent) department, if the student has not registered and not studied that subject under any category (Professional Core, Professional Electives, Mandatory Courses etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat/should not match with any category (Professional Core, Professional Electives, Mandatory Courses etc.) of subjects even in the forthcoming semesters.

- 4.10 **Professional Electives:** The students have to choose six Professional Electives (PE-I to VI) from the list of professional electives given.

5.0 Subjects/ courses to be offered

- 5.1 A subject/ course may be offered to the students, **only if** a minimum of 15 students opt for it.
- 5.2 More than **one faculty member** may offer the **same subject** (lab/ practical may be included with the corresponding theory subject in the same semester) in any semester. However, selection of choice for students will be based on - '**first come first serve** basis and CGPA criterion' (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).
- 5.3 If more entries for registration of a subject come into picture, then the Head of the Department concerned shall decide, whether or not to offer such a subject/ course for **two(or multiple) sections**.
- 5.4 In case of options coming from students of other departments/ branches/ disciplines (not considering **open electives**), first **priority** shall be given to the student of the '**parent department**'.

6.0 Attendance requirements:

- 6.1 A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects/ courses (including attendance in mandatory courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization Lab) for that semester. **Two periods** of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject. **This attendance should also be included in the attendance uploaded every fortnight in the University Website.**
- 6.2 Shortage of attendance in aggregate upto 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.
- 6.3 A stipulated fee shall be payable for condoning of shortage of attendance.
- 6.4 Shortage of attendance below 65% in aggregate shall in **NO** case be condoned.
- 6.5 **Students whose shortage of attendance is not condoned in any semester**

are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled, including all academic credentials (internal marks etc.) of that semester. **They will not be promoted to the next semester.** They may seek re-registration for all those subjects registered in that semester in which the student is detained, by seeking re-admission into that semester as and when offered; if there are any professional electives and/ or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

- 6.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7.0 Academic Requirements

The following academic requirements have to be satisfied, in addition to the attendancerequirements mentioned in Item No. 6.

- 7.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, if student secures not less than 35% (14 marks out of 40 marks including minimum 35% of average Mid-Term examinations for 25 marks) in the internal examinations, not less than 35% (21 marks out of 60 marks) in the semester end examination, and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing 'C' grade or above in that subject/ course.
- 7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Real-time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship (or) Seminar, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he (i) does not submit a report on Industry Oriented Mini Project/Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Real-time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship evaluations. A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such 'one reappearance' evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.3 Promotion Rules

S. No.	Promotion	Conditions to be fulfilled
1	First year first semester to first year second semester	Regular course of study of first year first semester.
2	First year second semester to Second year first semester	(i) Regular course of study of first year second semester. (ii) Must have secured at least 20 credits out of 40 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3.	Second year first semester to Second year second semester	Regular course of study of second year first semester.
4	Second year second semester to Third year first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to Third year second semester	Regular course of study of third year first semester.
6	Third year second semester to Fourth year first semester	(i) Regular course of study of third year second semester. (ii) Must have secured at least 72 credits out of 120 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7.	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester.

- 7.4 A student (i) shall register for all courses/subjects covering 160 credits as specified and listed in the course structure, (ii) fulfills all the attendance and academic requirements for 160 credits, (iii) earn all 160 credits by securing $SGPA \geq 5.0$ (in each semester), and $CGPA \geq 5$ (at the end of 8 semesters), (iv) **passes all the mandatory courses**, to successfully complete the undergraduate programme. The performance of the student in these 160 credits shall be considered for the calculation of the final CGPA (**at the end of undergraduate programme**), and shall be indicated in the grade card / marks memo of IV-year II semester.
- 7.5 If a student registers for '**extra subjects**' (in the parent department or other departments/branches of Engg.) other than those listed subjects totaling to 160 credits as specified in the course structure of his department, the performances in those '**extra subjects**' (although evaluated and graded using the same procedure as that of the required 160 credits) will not be considered while calculating the SGPA and CGPA. For such '**extra subjects**' registered, percentage of marks and letter grade alone will be indicated in the grade card / marks memo as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations Items 6 and 7.1 – 7.4 above.
- 7.6 A student eligible to appear in the semester end examination for any subject/course, but absent from it or failed (thereby failing to secure '**C**' grade or above) may reappear for that subject/ course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject/ course will be carried over, and added to the marks to be obtained in the SEE supplementary examination forevaluating performance in that subject.
- 7.7 A student **detained in a semester due to shortage of attendance may be re-admitted in the same semester in the next academic year for fulfillment of academic requirements**. The academic regulations under which a student has been re-admitted shall be applicable. Further, no grade allotments or SGPA/CGPA calculations will be done for the entire semester in which the student has been detained.
- 7.8 A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required number of academic credits**. The academic regulations under which the student has been readmitted shall be applicable to him.

8.0 Evaluation - Distribution and Weightage of Marks

- 8.1 The performance of a student in every subject/course (including practicals and Project Stage – I & II) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination).

- 8.2 In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) Part – A for 10 marks, ii) Part – B for 20 marks with a total duration of 2 hours as follows:
1. Mid Term Examination for 30 marks:
 - a. Part - A : Objective/quiz paper for 10 marks.
 - b. Part - B : Descriptive paper for 20 marks.

The objective/quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks. The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks. The average of the two Mid Term Examinations shall be taken as the final marks for Mid Term Examination (for 30 marks).

The remaining 10 marks of Continuous Internal Evaluation are distributed as:

1. Assignment for 5 marks. (Average of 2 Assignments each for 5 marks)
2. Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject for 5 marks.

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

Five (5) marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shall be taken as the final marks for assignment (for 5 marks).

Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the subject concerned for 5 marks before II Mid-Term Examination.

- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Over all 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores $\geq 35\%$ (14 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled in spite of appearing the SEE.

There is NO Remedial Mid Test (RMT) for R22 regulations.

The details of the end semester question paper pattern are as follows:

8.2.1 The semester end examinations (SEE), for theory subjects, will be conducted for 60 marks consisting of two parts viz. i) Part- A for 10 marks, ii) Part - B for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an “either” “or” choice, which means that there will be two questions from each unit and the student should answer either of the two questions.
- The duration of Semester End Examination is 3 hours.

8.3 For practical subjects there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of aim, components/procedure, expected outcome) which shall be evaluated for 10 marks
2. **10 marks for viva-voce** (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 10 marks.
4. The remaining 10 marks are for Laboratory Project, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the cluster / other colleges which will be decided by the examination branch of the University.

In the Semester End Examination held for 3 hours, total 60 marks are divided and allocated as shown below:

1. 10 marks for write-up
2. 15 for experiment/program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment/program in the same laboratory course and
5. 10 marks for viva-voce on concerned laboratory course

8.4 The evaluation of courses having ONLY internal marks in I-Year I Semester and II- Year II Semester is as follows:

1. I Year I Semester course (ex., *Elements of CE/ME/EEE/ECE/CSE*): The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-

Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.

2. II Year II Semester *Real-Time (or) Field-based Research Project* course: The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (ii) secures less than 40% marks in this course.

- 8.5 There shall be an Industry training (or) Internship (or) Industry oriented Mini-project (or) Skill Development Courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project in collaboration with an industry of their specialization. Students shall register for this immediately after II-Year II Semester Examinations and pursue it during summer vacation/semester break & during III Year without effecting regular course work. Internship at reputed organization (or) Skill development courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project (or) Internship etc, Internal Supervisor and a Senior Faculty Member of the Department. There shall be **NO internal marks** for Industry Training (or) Internship (or) Mini-Project (or) Skill Development Courses (or) Paper Presentation in reputed journal (or) Industry Oriented Mini Project.
- 8.6 The UG project shall be initiated at the end of the IV Year I Semester and the duration of the project work is one semester. The student must present Project Stage – I during IV Year I Semester before II Mid examinations, in consultation with his Supervisor, the title, objective and plan of action of his Project work to the departmental committee for approval before commencement of IV Year II Semester. Only after obtaining the approval of the departmental committee, the student can start his project work.
- 8.7 UG project work shall be carried out in two stages: Project Stage – I for approval of project before Mid-II examinations in IV Year I Semester and Project Stage – II during IV Year II Semester. Student has to submit project work report at the end of IV Year II Semester. The project shall be evaluated for 100 marks before commencement of SEETheory examinations.

8.8 For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall approve the project work to begin before II Mid-Term examination of IV Year I Semester. The student is deemed to be not eligible to register for the Project work, if he does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule. A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.9 For Project Stage – II, the external examiner shall evaluate the project work for 60 marks and the internal project committee shall evaluate it for 40 marks. Out of 40 internal marks, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 20 marks and Project Supervisor shall evaluate for 20 marks. The topics for Industry Oriented Mini Project/ Internship/SDC etc. and the main Project shall be different from the topic already taken. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

For conducting viva-voce of project, University selects an external examiner from the list of experts in the relevant branch submitted by the Principal of the College.

A student who has failed, may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.10 A student shall be given one time chance to re-register for a maximum of two subjects:

- If the internal marks secured by a candidate in Mid examinations (average of two mid-term examinations consisting of Objective & descriptive parts) are less than 35% and failed in those subjects (or)
- failed in Assignment & Subject Viva-voce/ PPT/Poster Presentation/ Case Study on a topic in the concerned subject but fulfilled the attendance requirement.

A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the classwork in next academic year. Also, the student has to earn 35% of total internal marks (14 out of 40 marks including Mid-Term examinations, Assignment & Subject Viva-voce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject).

In the event of the student taking this chance, his Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled.

9.0 Grading Procedure

- 9.1 Grades will be awarded to indicate the performance of students in each Theory Subject, Laboratory/Practicals/ Industry-Oriented Mini Project/Internship/SDC and Project Stage. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.
- 9.2 As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a Subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
Greater than or equal to 90%	O (Outstanding)	10
80 and less than 90%	A ⁺ (Excellent)	9
70 and less than 80%	A (Very Good)	8
60 and less than 70%	B ⁺ (Good)	7
50 and less than 60%	B (Average)	6
40 and less than 50%	C (Pass)	5
Below 40%	F (FAIL)	0
Absent	Ab	0

- 9.3 A student who has obtained an 'F' grade in any subject shall be deemed to have 'failed' and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.
- 9.4 To a student who has not appeared for an examination in any subject, 'Ab' grade will be allocated in that subject, and he is deemed to have 'Failed'. A student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remain the same as those obtained earlier.
- 9.5 A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

- 9.6 A student earns Grade Point (GP) in each subject/ course, on the basis of the letter grade secured in that subject/ course. The corresponding 'Credit Points' (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

Credit Points (CP) = Grade Point (GP) x Credits For a course

- 9.7 A student passes the subject/ course only when **GP ≥ 5 ('C' grade or above)**
- 9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (ΣCP) secured from all subjects/ courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

SGPA = $\{ \sum_{i=1}^N C_i G_i \} / \{ \sum_{i=1}^N C_i \}$ For each semester,

where 'i' is the subject indicator index (considering all subjects in a semester), 'N' is the no. of subjects '**registered**' for the semester (as specifically required and listed under the course structure of the parent department), C_i is the no. of credits allotted to the i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

- 9.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses (of 160) in **all** semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula

CGPA = $\{ \sum_{j=1}^M C_j G_j \} / \{ \sum_{j=1}^M C_j \}$... for all S semesters registered

(i.e., up to and inclusive of S semesters, $S \geq 2$),

where '**M**' is the total no. of subjects (as specifically required and listed under the course structure of the parent department) the student has '**registered**' i.e., from the 1st semester onwards up to and inclusive of the 8th semester, 'j' is the subject indicator index (takes into account all subjects from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA:

Course/Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8 = 32
Course 2	4	O	10	4 x 10 = 40
Course 3	4	C	5	4 x 5 = 20
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	C	5	3 x 5 = 15
	21			152

$$\text{SGPA} = 152/21 = 7.24$$

Illustration of Calculation of CGPA up to 3rd Semester:

Semester	Course/ Subject Title	Credits Allotted	Letter Grade Secured	Corresponding Grade Point (GP)	Credit Points (CP)
I	Course 1	3	A	8	24
I	Course 2	3	O	10	30
I	Course 3	3	B	6	18
I	Course 4	4	A	8	32
I	Course 5	3	A+	9	27
I	Course 6	4	C	5	20
II	Course 7	4	B	6	24
II	Course 8	4	A	8	32
II	Course 9	3	C	5	15
II	Course 10	3	O	10	30
II	Course 11	3	B+	7	21
II	Course 12	4	B	6	24
II	Course 13	4	A	8	32
II	Course 14	3	O	10	30
III	Course 15	2	A	8	16
III	Course 16	1	C	5	5
III	Course 17	4	O	10	40
III	Course 18	3	B+	7	21
III	Course 19	4	B	6	24
III	Course 20	4	A	8	32
III	Course 21	3	B+	7	21
	Total Credits	69		Total Credit Points	518

$$\text{CGPA} = 518/69 = 7.51$$

The calculation process of CGPA illustrated above will be followed for each subsequent semester until 8th semester. The CGPA obtained at the end of 8th semester will become the final CGPA secured for entire B.Tech. programme.

9.10 For merit ranking or comparison purposes or any other listing, **only** the

'rounded off' values of the CGPAs will be used.

- 9.11 SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in first attempt. Otherwise the SGPA and CGPA shall be mentioned only on the Memorandum of Grades in which sitting he passed his last exam in that semester. However, mandatory courses will not be taken into consideration.

10.0 Passing Standards

- 10.1 A student shall be declared successful or 'passed' in a semester, if he secures a GP ≥ 5 ('C' grade or above) in every subject/course in that semester (i.e. when the student gets an SGPA ≥ 5.0 at the end of that particular semester); and he shall be declared successful or 'passed' in the entire undergraduate programme, only when gets a CGPA ≥ 5.00 ('C' grade or above) for the award of the degree as required.
- 10.2 After the completion of each semester, a grade card or grade sheet shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, grade earned, etc.) and credits earned. **There is NO exemption of credits in any case.**

11.0 Declaration of results

- 11.1 Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9.
- 11.2 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

$$\% \text{ of Marks} = (\text{final CGPA} - 0.5) \times 10$$

12.0 Award of Degree

- 12.1 A student who registers for all the specified subjects/ courses as listed in the course structure and secures the required number of 160 credits (with CGPA ≥ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have '**qualified**' for the award of B.Tech. degree in the branch of Engineering selected at the time of admission.
- 12.2 A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.
- 12.3 A student with final CGPA (at the end of the undergraduate programme) > 8.00 , and fulfilling the following conditions - shall be placed in '**First Class with Distinction**'. However, he
- (i) Should have passed all the subjects/courses in '**First Appearance**' within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.
 - (ii) Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.

A student not fulfilling any of the above conditions with final CGPA > 8 shall be placed in **'First Class'**.

12.4 Students with final CGPA (at the end of the undergraduate programme) ≥ 7.0 but < 8.00 shall be placed in **'First Class'**.

12.5 Students with final CGPA (at the end of the undergraduate programme) ≥ 6.00 but < 7.00, shall be placed in **'Second Class'**.

12.6 All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the undergraduate programme) ≥ 5.00 but < 6, shall be placed in **'pass class'**.

12.7 A student with final CGPA (at the end of the undergraduate programme) < 5.00 will not be eligible for the award of the degree.

12.8 Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of **'Gold Medal'**.

12.9 **Award of 2-Year B.Tech. Diploma Certificate**

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (with in 4 years from the date of admission) upto B. Tech. – II Year – II Semester, if the student want to exit the 4-Year B. Tech. program. The student **once opted and awarded for 2-Year UG Diploma Certificate, the student will not be permitted to join** in B. Tech. III Year – I Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree.
2. A student may be permitted to take one year break after completion of II Year – II Semester or B. Tech. – III Year – II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program).

13.0 Withholding of results

- 1.3.1 If the student has not paid the fees to the University at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

14.0 Transitory Regulations

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of R18 Regulations due to lack of attendance, shall be permitted to join I year I Semester of R22 Regulations and he is required to complete the study of B.Tech./B. Pharmacy programme within the stipulated period of eight academic years from the date of first admission in I Year.
2. A student who has been detained in any semester of II, III and IV years of R18 regulations for want of attendance, shall be permitted to join the corresponding semester of R22 Regulations and is required to complete the study of B.Tech./B. Pharmacy within the stipulated period of eight academic years from the date of first admission in I Year. The R22 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

3. A student of R18 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of R22 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including both R18 & R22 regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The R22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in R22 Regulations:

4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R22 Regulations. **There is NO exemption of credits in any case.**
6. If a student is readmitted to R22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R22 Regulations will be substituted by another subject to be suggested by the University.

Note: If a student readmitted to R22 Regulations and has not studied any subjects/topics in his/her earlier regulations of study which is prerequisite for further subjects in R22 Regulations, the College Principals concerned shall conduct remedial classes to cover those subjects/topics for the benefit of the students.

15.0 Student Transfers

- 15.1 There shall be no branch transfers after the completion of admission process.
- 15.2 There shall be no transfers from one college/stream to another within the constituent colleges and units of Jawaharlal Nehru Technological University Hyderabad.
- 15.3 The students seeking transfer to colleges affiliated to JNTUH from various other Universities/institutions have to pass the failed subjects which are equivalent to the subjects of JNTUH, and also pass the subjects of JNTUH which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of JNTUH, the students have to study those subjects in JNTUH in spite of the fact that those subjects are repeated.
- 15.4 The transferred students from other Universities/Institutions to JNTUH affiliated colleges who are on rolls are to be provided one chance to write the CBT (for internal marks) in the **equivalent subject(s)** as per the clearance letter issued by the University.
- 15.5 The autonomous affiliated colleges have to provide one chance to write the internal examinations in the equivalent subject(s) to the students transferred from other universities/ institutions to JNTUH autonomous affiliated colleges who are on rolls, as per the clearance (equivalence) letter issued by the University.

16.0 Scope

The academic regulations should be read as a whole, for the purpose of any interpretation.

In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

The University may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the University authorities.

Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.



SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution)

Sheriguda(V), Ibrahimpatnam(M), R.R.Dist. - 501510

ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME) FROM THE AY 2023-24

1. Eligibility for the award of B.Tech Degree (LES)

The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.

2. The student shall register for 120 credits and secure 120 credits with CGPA ≥ 5 from II year to IV-year B.Tech. programme (LES) for the award of B.Tech. degree.

3. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.

4. The attendance requirements of B. Tech. (Regular) shall be applicable to B.Tech. (LES).

5. Promotion rule

S. No	Promotion	Conditions to be fulfilled
1	Second year first semester to second year second semester	Regular course of study of second year first semester.
2	Second year second semester to third year first semester	i. Regular course of study of second year second semester. ii. Must have secured at least 24 credits out of 40 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to third year second semester	Regular course of study of third year first semester.

4	Third year second semester to fourth year first semester	<p>i. Regular course of study of third year second semester.</p> <p>ii. Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.</p>
5	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester.

6. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).
7. LES students are not eligible for 2-Year B. Tech. Diploma Certificate.

Malpractices Rules

Disciplinary Action For / Improper Conduct in Examinations

	Nature of Malpractices/Improper conduct	Punishment
	If the student:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students 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 subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the student is to be cancelled and sent to the University.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student 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 subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the chief superintendent/assistant – superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of 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 subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.

8.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
9.	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared for including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared for including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award a suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.
2. Punishment for Institutions: (if the squad reports that the college is also involved in encouraging malpractices)
 - a. A show-cause notice shall be issued to the college.
 - b. Impose a suitable fine on the college.
 - c. Shifting the examination center from one college to another college for a specific period of not less than one year.

* * * * *

Frequently asked Questions and Answers about autonomy

1. Who grants Autonomy? UGC, Govt., AICTE or University

In case of Colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy.

2. Shall SICET award its own Degrees?

No. Degree will be awarded by Jawaharlal Nehru Technological University, Hyderabad with a mention of the name SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY on the Degree Certificate.

3. What is the difference between a Deemed University and an Autonomy College?

A Deemed University is fully autonomous to the extent of awarding its own Degree. A Deemed University is usually a Non-Affiliating version of a University and has similar responsibilities like any University. An Autonomous College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4. How will the Foreign Universities or other stake – holders know that we are an Autonomous College?

Autonomous status, once declared, shall be accepted by all the stake holders. Foreign Universities and Indian Industries will know our status through our college website.

5. What is the change of Status for Students and Teachers if we become Autonomous?

An autonomous college carries a prestigious image. Autonomy is actually earned out of continued past efforts on academic performances, capability of self-governance and the kind of quality education we offer.

6. Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?

There is a built in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Programme Evaluation Committee is a Non – Statutory body, which will keep a watch on the academics and keep its reports and recommendations every year. In addition to Academic Council, the highest academic body also supervises the academic matters. At the end of three years, there is an external inspection by the University for this purpose. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7. Will the students of SICET as an Autonomous College qualify for University Medals and Prizes for academic excellence?

No, SICET has instituted its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural and co-curricular organized by the University the students shall qualify.

8. Can SICET have its own Convocation?

No, since the University awards the Degree the Convocation will be that of the University.

9. Can SICET give a provisional degree certificate?

Since the examinations are conducted by SICET and the results are also declared by SICET, the college sends a list of successful candidates with their final percentage of marks to the University. Therefore with the prior permission of the University the college will be entitled to give the provisional certificate.

10. Will Academic Autonomy make a positive impact on the Placements or Employability?

Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment, besides the autonomous status is more responsive to the needs of the industry. As a result, there will be a lot of scope for industry oriented skill development built-in into the system. The graduates from an autonomous college will therefore represent better employability.

11. What is the proportion of Internal and External Assessment as an Autonomous College?

Presently, it is 30% for internal assessment and 70% for external assessment. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12. Will there be any Revaluation or Re-Examination System?

No. There will not be any Revaluation system or Re-examination. But, there is a personal verification of the answer scripts.

13. How fast Syllabi can be and should be changed?

Autonomy allows us the freedom to change the syllabi as often as we need.

14. Will the Degree be awarded on the basis of only final year performance?

No. The percentage of marks will reflect the average performance of all the semesters put together.

15. Who takes Decisions on Academic matters?

The Academic Council of College is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like the BOS which are like Boards of Studies of the University.

16. What is the role of Examination committee?

The Exam Committee is responsible for the smooth conduct of inter and external examinations. All matters involving the conduct of examinations, spot valuations, tabulations, preparation of Memorandum of Marks etc fall within the duties of the Examination Committee.

17. Is there any mechanism for Grievance Redressal?

Yes, the college has grievance redressal committee, headed by a senior faculty member of the college.

18. How many attempts are permitted for obtaining a Degree?

All such matters are defined in Rules & Regulations.

19. Who declares the result?

The result declaration process is also defined. After tabulation work the entire result is reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the College Academic Council for its approval. The result is then declared on the college notice boards as well put on the web site of the college. It is eventually sent to the University.

20. What is our relationship with the Jawaharlal Nehru Technological University, Hyderabad?

We remain an affiliated college of the Jawaharlal Nehru Technological University, Hyderabad. The University has the right to nominate its members on the academic bodies of the college.

21. Shall we require University approval if we want to start any New Courses?

Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

22. Shall we get autonomy for PG and Doctoral Programmes also?

Yes, presently our PG programmes are also enjoying autonomous status.

23. How many exams will be there as an autonomous college?

This is defined in the Rules & Regulations.

24. Is the College adapting Choice Based Credit System (CBCS) or Not ?

Yes, this College has adapted CBCS system with effect from the Academic Year 2016-17.

25. Note : What is Choice Based Credit System (CBCS)?

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

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY
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Choice Based Credit System (CBCS)

REGULATIONS – BR22

B. Tech. Mechanical Engineering

I YEAR I SEMESTER

COURSE STRUCTURE

S. No.	Course Code	Course Title	L	T	P	Credits
1.	R22MTH1111	Matrices and Calculus	3	1	0	4
2.	R22APH1112	Applied Physics	3	1	0	4
3.	R22CSE1115	C Programming and Data Structures	3	0	0	3
4.	R22MED1124	Engineering Workshop	0	1	3	2.5
5.	R22HAS1115	English for Skill Enhancement	2	0	0	2
6.	R22MED1126	Elements of Mechanical Engineering	0	0	2	1
7.	R22APH1127	Applied Physics Laboratory	0	0	3	1.5
8.	R22HAS1128	English Language and Communication Skills Laboratory	0	0	2	1
9.	R22CSE1129	C Programming and Data Structures Laboratory	0	0	2	1
10.		Induction Programme				
		Total	11	3	12	20

I YEAR II SEMESTER

COURSE STRUCTURE

S. No.	Course Code	Course Title	L	T	P	Credits
1.	R22MTH1211	Ordinary Differential Equations and Vector Calculus	3	1	0	4
2.	R22CHE1112	Engineering Chemistry	3	1	0	4
3.	R22MED1125	Computer Aided Engineering Graphics	1	0	4	3
4.	R22MED1214	Engineering Mechanics	3	0	0	3
5.	R22MED1215	Engineering Materials	2	0	0	2
6.	R22CSE1227	Python Programming Laboratory	0	1	2	2
7.	R22CHE1127	Engineering Chemistry Laboratory	0	0	2	1
8.	R22MED1228	Fuels & Lubricants Laboratory	0	0	2	1
		Total	12	3	10	20

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REGULATIONS – BR22

B. Tech. Mechanical Engineering

II YEAR I SEMESTER

COURSE STRUCTURE

S. No.	Course Code	Course Title	L	T	P	Credits
1.	R22MTH2113	Probability, Statistics & Complex Variables	3	1	0	4
2.	R22MED2112	Mechanics of Solids	3	0	0	3
3.	R22MED2113	Metallurgy & Material Science	3	0	0	3
4.	R22MED2114	Production Technology	3	0	0	3
5.	R22MED2115	Thermodynamics	3	1	0	4
6.	R22MED2126	Production Technology Laboratory	0	0	2	1
7.	R22MED2127	Material Science & Mechanics of Solids Laboratory	0	0	2	1
8.	R22MED2129	Computer Aided Machine Drawing	0	0	2	1
9.	R22MAC2110	Constitution of India	3	0	0	0
		Total Credits	18	2	6	20

II YEAR II SEMESTER

COURSE STRUCTURE

S. No.	Course Code	Course Title	L	T	P	Credits
1.	R22EEE2211	Basic Electrical and Electronics Engineering	3	0	0	3
2.	R22MED2212	Kinematics of Machinery	3	0	0	3
3.	R22MED2213	Fluid Mechanics & Hydraulic Machines	3	0	0	3
4.	R22MED2214	IC Engines & Gas Turbines	3	0	0	3
5.	R22MED2215	Instrumentation and Control Systems	3	0	0	3
6.	R22EEE2226	Basic Electrical and Electronics Engineering Laboratory	0	0	2	1
7.	R22MED2227	Fluid Mechanics & Hydraulic Machines Laboratory	0	0	2	1
8.	R22MED2228	Instrumentation and Control Systems Laboratory	0	0	2	1
9.	R22MED2269	Real-time Research Project/ Field-Based Project	0	0	4	2
10.	R22MAC2120	Gender Sensitization Lab	0	0	2	0
		Total Credits	15	0	12	20

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REGULATIONS – BR22

B. Tech. Mechanical Engineering

III YEAR I SEMESTER

COURSE STRUCTURE

S. No.	Course Code	Course Title	L	T	P	Credits
1.	R22MED3111	Dynamics of Machinery	3	0	0	3
2.	R22MED3112	Design of Machine Elements	3	0	0	3
3.	R22MED3113	Metrology & Machine Tools	3	0	0	3
4.	R22HMS1212	Business Economics & Financial Analysis	3	0	0	3
5.	R22MED3115	Steam Power & Jet Propulsion	3	0	0	3
6.	R22MED3116	Finite Element Methods	2	0	0	2
7.	R22MED3127	Thermal Engineering Laboratory	0	0	2	1
8.	R22MED3128	Metrology & Machine Tools Laboratory	0	0	2	1
9.	R22MED3129	Kinematics & Dynamics Laboratory	0	0	2	1
10.	R22MAC3110	Intellectual Property Rights	3	0	0	0
		Total Credits	20	0	6	20

III YEAR II SEMESTER

COURSE STRUCTURE

S. No	Course Code	Course Title	L	T	P	Credits
1.	R22MED3211	Machine Design	3	0	0	3
2.	R22MED3212	Heat Transfer	3	0	0	3
3.	R22MED3213	CAD/CAM	3	0	0	3
4.	Professional Elective - I		3	0	0	3
	R22ECE3243	Microprocessors in Automation				
	R22MED3241	Mechanical Vibrations				
	R22MED3242	Power Plant Engineering				
	R22MED3244	Unconventional Machining Processes				
5.	Open Elective - I		3	0	0	3
6.	R22MED3226	Heat Transfer Lab	0	0	2	1
7.	R22MED3228	Computer Aided Engineering Laboratory	0	0	2	1
8.	R22HAS3228	Advanced English Communication Skills Laboratory	0	0	2	1
9.	R22MED3269	Industry Oriented Mini Project/ Internship	0	0	4	2
10.	R22MAC1110	Environmental Science	3	0	0	0
		Total Credits	18	0	10	20

Environmental Science in III Yr II Sem Should be Registered by Lateral Entry Students Only.

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Choice Based Credit System (CBCS)

REGULATIONS – BR22

B. Tech. Mechanical Engineering**IV YEAR I SEMESTER****COURSE STRUCTURE**

S. No.	Course Code	Course Title	L	T	P	Credits
1.	R22MED4111	Industrial Management	2	0	0	2
2.	R22MED4112	Refrigeration & Air Conditioning	3	0	0	3
3.	Professional Elective – II		3	0	0	3
	R22CSM4142	Artificial Intelligence in Mechanical Engineering				
	R22MED4141	Industrial Robotics				
	R22MED4142	Mechatronics				
	R22MED4143	Automobile Engineering				
4.	Professional Elective – III		3	0	0	3
	R22MED4144	Composite Materials				
	R22MED4145	Computational Fluid Dynamics				
	R22MED4146	Production Planning & Control				
	R22MED4147	Solar Energy Technology				
5.	Professional Elective - IV		3	0	0	3
	R22MED4149	Renewable Energy Sources				
	R22MED4148	Fundamentals of Electric and Hybrid Vehicles				
	R22MED4165	Re-Engineering				
	R22MTH4145	Operations Research				
6.	Open Elective - II		3	0	0	3
7.	R22MED4167	Project Stage - I	0	0	6	3
		Total Credits	17	0	6	20

IV YEAR II SEMESTER**COURSE STRUCTURE**

S. No.	Course Code	Course Title	L	T	P	Credits
1.	Professional Elective – V		3	0	0	3
	R22MED4248	Energy Conservation and Management				
	R22MED4241	Additive Manufacturing				
	R22MED4242	Automation in Manufacturing				
	R22MED4243	Turbo Machinery				
2.	Professional Elective - VI		3	0	0	3
	R22MED4244	Fluid Power System				
	R22MED4245	Fuzzy Logic and ANN				
	R22MED4246	Industry 4.0				
	R22MED4247	Total Quality Management				
3.	Open Elective - III		3	0	0	3
4.	R22MED4264	Project Stage – II including seminar	0	0	22	9+2
		Total Credits	9	0	22	20

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B.Tech. - I Year – I Semester

L	T	P	C
3	1	0	4

(R22MTH1111) MATRICES AND CALCULUS

Course Objectives: To learn

- Types of matrices and their properties.
- Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
- Concept of eigenvalues and eigenvectors and to reduce the quadratic form to canonical form
- Geometrical approach to the mean value theorems and their application to the mathematical problems
- Evaluation of surface areas and volumes of revolutions of curves.
- Evaluation of improper integrals using Beta and Gamma functions.
- Partial differentiation, concept of total derivative
- Finding maxima and minima of function of two and three variables.
- Evaluation of multiple integrals and their applications

Course outcomes: After learning the contents of this paper the student must be able to

1. Write the matrix representation of a set of linear equations and to analyse the solution of the system of equations
2. Find the Eigenvalues and Eigen vectors, Reduce the quadratic form to canonical form using orthogonal transformations.
3. Solve the applications on the mean value theorems.
4. Evaluate the improper integrals using Beta and Gamma functions
5. Find the extreme values of functions of two variables with/ without constraints.
6. Evaluate the multiple integrals and apply the concept to find areas, volumes

UNIT-I: Matrices

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, LU Decomposition method, Gauss Jacobi's and Gauss Seidel Iteration Method.

UNIT-II: Eigen values and Eigen vectors

Linear Transformation and Orthogonal Transformation: Eigenvalues, Eigenvectors and their properties with reference to inverse, Transpose, Symmetric, Skew-Symmetric, Hermetian, Skew-Hermetian, Orthogonal and Unitary matrices, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT-III: Calculus

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series.

Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (Only in Cartesian coordinates), Definition of Improper Integral: Beta and Gamma functions and their applications.

UNIT-IV: Multivariable Calculus (Partial Differentiation and applications)

Definitions of Limit and continuity.

Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Taylor's series for two variables. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT-V: Multivariable Calculus (Integration)

Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) for triple integrals.

Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals).

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

REFERENCE BOOKS:

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

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B.Tech. - I Year – I Semester

L	T	P	C
3	1	0	4

(R22APH1112) APPLIED PHYSICS

Course Objectives: The objectives of this course for the student are to:

1. Understand the basic principles of quantum physics and band theory of solids.
2. Understand the underlying mechanism involved in construction and working principles of various semiconductor devices.
3. Study the fundamental concepts related to the dielectric, magnetic and energy materials.
4. Identify the importance of nano scale, quantum confinement and various fabrications techniques.
5. Study the characteristics of lasers and optical fibres.

Course Outcomes: At the end of the course the student will be able to:

1. Understand physical world from fundamental point of view by the concepts of Quantum mechanics and visualize the difference between conductor, semiconductor, and an insulator by classification of solids.
2. Identify the role of semiconductor devices in science and engineering Applications.
3. Explore the fundamental properties of dielectric, magnetic materials and energy for their applications.
4. Appreciate the features and applications of Nano materials.
5. Understand various aspects of Lasers and Optical fiber and their applications in diverse fields.
6. Understand the relation between various parameters or variables.

UNIT - I: QUANTUM PHYSICS AND SOLIDS

Quantum Mechanics: Introduction to quantum physics, blackbody radiation – Stefan-Boltzmann's law, Wien's and Rayleigh-Jean's law, Planck's radiation law - photoelectric effect – de Broglie concept of matter waves - Davisson and Germer experiment –Heisenberg uncertainty principle – Physical significance of the wave function – time independent Schrodinger wave equation - particle in one dimensional potential box.

Solids: Symmetry in solids, free electron theory (Drude & Lorentz, Sommerfeld) - Fermi-Dirac distribution - Bloch's theorem -Kronig-Penney model – E-K diagram- effective mass of electron- origin of energy bands- classification of solids.

UNIT - II: SEMICONDUCTORS AND DEVICES

Intrinsic and extrinsic semiconductors – Hall effect - direct and indirect band gap semiconductors - construction, principle of operation and characteristics of P-N Junction diode, Zener diode and bipolar junction transistor (BJT) – Operation of PNP and NPN Transistors. LED, PIN diode, avalanche photo diode (APD) and solar cells, their structure, materials, working principle and characteristics.

UNIT - III: DIELECTRIC, MAGNETIC AND ENERGY MATERIALS

Dielectric Materials: Basic definitions- types of polarizations (qualitative) - ferroelectric, piezoelectric, and Pyro electric materials – applications – liquid crystal displays (LCD) and crystal oscillators.

Magnetic Materials: Introduction-Hysteresis-soft and hard magnetic materials - magneto striction, magneto resistance - applications - bubble memory devices, magnetic field sensors and multi ferroics.

Energy Materials: Conductivity of liquid and solid electrolytes (qualitative) - super ionic conductors - materials and electrolytes for super capacitors - rechargeable ion batteries, solid fuel cells.

UNIT - IV: NANOTECHNOLOGY

Introduction, Nano scale, quantum confinement, surface to volume ratio, bottom-up fabrication: sol-gel, precipitation, combustion methods. Top-down fabrication: ball milling - physical vapor deposition (PVD) - chemical vapor deposition (CVD). Characterization techniques - XRD, SEM & TEM. Applications of nano materials.

UNIT - V: LASER AND FIBER OPTICS

Lasers: Laser beam characteristics-three quantum processes(Stimulated absorption, spontaneous emission and stimulated emission) -Einstein coefficients and their relations- lasing action - pumping methods- ruby laser, He-Ne laser, CO₂ laser, - semiconductor laser-applications of laser.

Fiber Optics: Introduction to optical fiber- advantages of optical Fibers - total internal reflection-construction of optical fiber - acceptance angle - numerical aperture- classification of optical fibers-losses in optical fiber - optical fiber for communication system - applications.

TEXT BOOKS:

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy” A Text book of Engineering Physics”- S. Chand Publications, 11th Edition 2019.
2. Engineering Physics by Shatendra Sharma and Jyotsna Sharma, Pearson Publication,2019
3. Semiconductor Physics and Devices- Basic Principle – Donald A, Neamen, Mc Graw Hill, 4thEdition,2021.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2ndEdition,2022.
5. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 1st Edition, 2021.

REFERENCE BOOKS:

1. Quantum Physics, H.C. Verma, TBS Publication, 2nd Edition 2012.
2. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley & Sons, 11th Edition, 2018.
3. Introduction to Solid State Physics, Charles Kittel, Wiley Eastern, 2019.
4. Elementary Solid State Physics, S.L. Gupta and V. Kumar, Pragathi Prakashan, 2019.
5. A.K. Bhandhopadhyaya - Nano Materials, New Age International, 1stEdition, 2007.
6. Energy Materials a Short Introduction to Functional Materials for Energy Conversion and Storage Aliaksandr S. Bandarenka, CRC Press Taylor & Francis Group Energy Materials Taylor & Francis Group, 1st Edition, 2022.

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B.Tech. - I Year – I Semester

L	T	P	C
3	0	0	3

(R22CSE1115) C PROGRAMMING AND DATA STRUCTURES

Course Outcomes:

1. Understand the various steps in Program development.
2. Explore the basic concepts in C Programming Language.
3. Develop modular and readable C Programs
4. Understand the basic concepts such as Abstract Data Types, Linear and Non-Linear Datastructures.
5. Apply data structures such as stacks, queues in problem solving
6. To understand and analyze various searching and sorting algorithms.

UNIT - I

Introduction to Computers – **Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Software Development**
Introduction to C Language – Background, Simple C programs, Identifiers, Basic data types, Variables, Constants, Input / Output
Structure of a C Program – **Operators, Bit-wise operators, Expressions, Precedence and Associativity, Expression Evaluation, Type conversions, Statements.**

UNIT - II

Statements – **if and switch statements, Repetition statements – while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to, Recursion.**
Designing Structured Programs- Functions, basics, user defined functions, inter function communication, standard functions.
Arrays – **Concepts, using arrays in C, inter function communication, array applications, two –dimensional arrays, multidimensional arrays.**

UNIT - III

Pointers – **Introduction, Pointers for inter function communication, pointers to pointers, compatibility, Pointer Applications – Passing an array to a function, Memory allocation functions, array of pointers** Strings – **Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion.**

UNIT - IV

Derived types – **The Typedef, enumerated types, Structures – Declaration, definition and initialization of structures, accessing structures, operations on structures, complex structures. Unions – Referencing unions, initializers, unions and structures.**
Input and Output – **Text vs Binary streams, standard library functions for files, converting file types, File programs – copy, merge files.**

UNIT – V

Sorting- **selection sort, bubble sort, insertion sort, Searching-linear and binary search methods.**
Data Structures – **Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.**

Text Books:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, CengageLearning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/PearsonEducation

Reference Books:

1. C & Data structures – P. Padmanabham, 3rd Edition, B.S. Publications.
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
- 3 Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
4. C for Engineers and Scientists, H. Cheng, McGraw-Hill International Edition
5. Data Structures using C – A. M. Tanenbaum, Y. Langsam, and M.J. Augenstein, PearsonEducation / PHI
6. C Programming & Data Structures, E. Balagurusamy, TMH.
7. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press
8. C & Data structures – E V Prasad and N B Venkateswarlu, S. Chand & Co.

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B.Tech. - I Year – I Semester

L T P C
0 1 3 2.5

(R22MED1124) ENGINEERING WORKSHOP

Course Objectives:

- To Study of different hand operated power tools, uses and their demonstration.
- To gain a good basic working knowledge required for the production of various engineering products.
- To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
- To develop a right attitude, team working, precision and safety at work place.
- It explains the construction, function, use and application of different working tools, equipment and machines.
- To study commonly used carpentry joints.
- To have practical exposure to various welding and joining processes.
- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

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

1. Study and practice on machine tools and their operations
2. Practice on manufacturing of components using workshop trades including plumbing, fitting, carpentry.
3. To understand the foundry, house wiring and welding Trades.
4. Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
5. Apply basic electrical engineering knowledge for house wiring practice.

Syllabus :

- Introduction to Carpentry : Types Wood, Sizes of Wood or Timber, Characteristics of Wood, Types of Marking and Measuring Tools, Holding Tools, Cutting Tools, Planing Tools, Types of Chisels and their specifications, Drilling and Boring Tools and their Sketches, Wood Working Lathe and its parts, Drilling Machine and its parts, Types of saws, Sawing Machines such as Jigsaw, Bandsaw, Scrollsaw etc., Care and Maintenance of Tools.
- Introduction to Fitting : Holding Tools, Marking and Measuring Tools, Cutting Tools, Taps and Tap Wrenches, Dies and Die Holders, Bench Drilling Machine with Sketch and Specifications, Types of Files, File Card, Types of Hammers, Spanners, Screwdrivers, Fitting operations, Forms of Materials, Care and Maintenance of Tools
- Introduction of Tin-Smithy : Sheet Materials, Hand Tools, Hammers, Stakes, Sheet Metal Joints, Revets and Screws, Soldering and Brazing.
- Introduction to Foundry : Casting and its components such as Molding sands and their types, Properties, Types patterns, Pattern making materials, Tools used for the Molding, Melting Furnaces such as Cupola, Pot Furnace, Crucible Furnace
- Introduction to Welding : Various Welding processes such as Arc Welding, Gas Welding, Resistance Welding, Thermit Welding, Friction Welding, Elementary Symbols of the Welding, Transformers, Motor Generators, Rectifyers, Welding cables, Electrodes and their types, Electrode Holders, Techniques of Welding, Gas Welding their Types
- Introduction to House-wiring : Types of the Tools using House-wiring, Types of Housewiring System, Fuses, Circuit Breakers, Switches, Sockets and Common House-wiring Methods,

Various Symbol for Electrical Items.

- Introduction to Black Smithy : Tools and equipment used in the Black Smithy, Forging Temperatures of metals.
- Introduction to the Plumbing, Machine Shop, Metal Cutting, Power Tools.

1. Trades for Exercises:

At least two exercises from each trade:

- I. Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
- II. Fitting – (V-Fit, Dovetail Fit & Semi-circular fit)
- III. Tin-Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
- IV. Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
- V. Welding Practice – (Arc Welding & Gas Welding)
- VI. House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
- VII. Black Smithy – (Round to Square, Fan Hook and S-Hook)

2.Trades for Demonstration & Exposure:

Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools in construction and WoodWorking

Text Books:

1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K. Venugopal / Anuradha.

Reference Books:

1. Work shop Manual - P. Kanniah/ K.L. Narayana/ Scitech
2. Workshop Manual / Venkat Reddy/ BSP

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L	T	P	C
2	0	0	2

(R22HAS1115) ENGLISH FOR SKILL ENHANCEMENT

Course Objectives: This course will enable the students to:

1. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Develop study skills and communication skills in various professional situations.
3. Equip students to study engineering subjects more effectively and critically using the theoretical and practical components of the syllabus.

Course Outcomes: Students will be able to:

1. Understand the importance of vocabulary and sentence structures.
2. Choose appropriate vocabulary and sentence structures for their oral and written communication.
3. Demonstrate their understanding of the rules of functional grammar.
4. Develop comprehension skills from the known and unknown passages.
5. Take an active part in drafting paragraphs, letters, essays, abstracts, précis and reports in various contexts.
6. Acquire basic proficiency in reading and writing modules of English.

UNIT - I

Chapter entitled ‘*Toasted English*’ by R.K.Narayan from “*English: Language, Context and Culture*” published by Orient BlackSwan, Hyderabad.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.

Reading: Reading and Its Importance- Techniques for Effective Reading.

Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT - II

Chapter entitled ‘Appro JRD’ by Sudha Murthy from “*English: Language, Context and Culture*” published by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice

Writing: Nature and Style of Writing- Defining /Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence.

UNIT - III

Chapter entitled ‘Lessons from Online Learning’ by F.Haider Alvi, Deborah Hurst et al from “*English: Language, Context and Culture*” published by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Reading: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for

Practice.
Writing: Format of a Formal Letter-Writing Formal Letters E.g., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.

UNIT - IV

Chapter entitled 'Art and Literature' by Abdul Kalam from "*English: Language, Context and Culture*" published by Orient BlackSwan, Hyderabad.

Vocabulary: Standard Abbreviations in English

Grammar: Redundancies and Clichés in Oral and Written Communication.

Reading: Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice

Writing: Writing Practices- Essay Writing-Writing Introduction and Conclusion -Précis Writing.

UNIT - V

Chapter entitled 'Go, Kiss the World' by Subroto Bagchi from "*English: Language, Context and Culture*" published by Orient BlackSwan, Hyderabad.

Vocabulary: Technical Vocabulary and their Usage

Grammar: Common Errors in English (*Covering all the other aspects of grammar which were not covered in the previous units*)

Reading: Reading Comprehension-Exercises for Practice

Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

Note: Listening and Speaking Skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.

- Note: 1. As the syllabus of English given in AICTE Model Curriculum-2018 for B.Tech First Year is Open-ended, besides following the prescribed textbook, it is required to prepare teaching/learning materials by the teachers collectively in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.
- Note: 2. Based on the recommendations of NEP2020, teachers are requested to be flexible to adopt Blended Learning in dealing with the course contents. They are advised to teach 40 percent of each topic from the syllabus in blended mode.

Text Book:

1. "English: Language, Context and Culture" by Orient BlackSwan Pvt. Ltd, Hyderabad. 2022. Print.

Reference Books:

1. Effective Academic Writing by Liss and Davis (OUP)
2. Richards, Jack C. (2022) Interchange Series. Introduction, 1,2,3. Cambridge University Press
3. Wood, F.T. (2007). Remedial English Grammar. Macmillan.
4. Chaudhuri, Santanu Sinha. (2018). Learn English: A Fun Book of Functional Language, Grammar and Vocabulary. (2nd ed.). Sage Publications India Pvt. Ltd.
5. (2019). Technical Communication. Wiley India Pvt. Ltd.
6. Vishwamohan, Aysha. (2013). English for Technical Communication for Engineering Students. Mc Graw-Hill Education India Pvt. Ltd.
7. Swan, Michael. (2016). Practical English Usage. Oxford University Press. Fourth Edition.

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(R22MED1126) ELEMENTS OF MECHANICAL ENGINEERING

Course Objectives: The objectives of this course are to

1. Make the student to experimentally measure the common geometric properties like length, diameter, flatness, curvature, volume and moment of inertia etc.
2. Give a practical knowledge to evaluate the friction between surfaces and also to evaluate the natural frequency of the system.
3. Correlate between theory and experimental results, directly observe the proof of principles and theories through practical knowledge
4. Introduce students to the basic concepts of manufacturing through the demonstration of various processes.
5. Understand the commonly used mechanical components like gear box, working of boilers and IC engine etc.

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

1. CO 1: Understand the operation, usage and applications of different measuring instruments and tools.
2. CO 2: Examine the different characteristics of instruments like accuracy, precision etc
3. CO 3: Prepare simple composite components and joining different materials using soldering process.
4. CO 4: Identify tools & learn practically the process of turning, milling, grinding on mild steel pieces.
5. CO 5: Understand the basic components of IC engine, Gear box and boiler

List of Experiments to be performed:

1. Measurement of length, height, diameter by vernier calipers.
2. To measure diameter of a given wire and sphere, thickness of a given sheet and volume of an irregular lamina using micrometer screw gauge.
3. Use of straight edge and spirit level in finding the flatness of surface plate.
4. Determination of time period and natural frequency of simple pendulum.
5. Determination of time period and natural frequency of compound pendulum.
6. To measure the coefficients of static and kinetic friction between a block and a plane using various combination of materials.
7. To determine the radius of curvature of a given spherical surface.
8. The experimental determination of the Moment of Inertia of regular and irregular solids.
9. Metal joining process–soldering of metal alloys to any PCB board
10. A simple composite geometry preparation by hand layup method.
11. Grouping of Dry cells for a specified voltage and current and its measurement using ammeters and voltmeters etc.
12. Demonstration of lathe, milling, drilling, grinding machine operations.
13. Study of transmission system –gear box
14. Assembly /disassembly of Engines
15. Study of Boilers

Note: **Perform any 10 out of the 15 Exercises.**

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(R22APH1127) APPLIED PHYSICS LABORATORY

Course Objectives: The objectives of this course for the student to

1. Capable of handling instruments related to the Hall effect and photoelectric effect experiments and their measurements.
2. Understand the characteristics of various devices such as PN junction diode, Zener diode, BJT, LED, solar cell, lasers and optical fiber and measurement of energy gap and resistivity of semiconductor materials.
3. Able to measure the characteristics of dielectric constant of a given material.
4. Study the behavior of B-H curve of ferromagnetic materials.
5. Understanding the method of least squares fitting.

Course Outcomes: The students will be able to:

1. Know the determination of the Planck's constant using Photo electric effect and identify the material whether it is n-type or p-type by Hall experiment.
2. Appreciate quantum physics in semiconductor devices and optoelectronics.
3. Gain the knowledge of applications of dielectric constant.
4. Understand the variation of magnetic field and behavior of hysteresis curve.
5. Carried out data analysis by the method of least squares.
6. Understanding the characteristics of laser and signal transmission in optical fiber.

LIST OF EXPERIMENTS:

1. Determination of work function and Planck's constant using photoelectric effect.
2. Determination of Hall co-efficient and carrier concentration of a given semiconductor.
3. Characteristics of series and parallel LCR circuits.
4. V-I characteristics of a p-n junction diode and Zener diode
5. Input and output characteristics of BJT (CE, CB & CC configurations)
6. a) V-I and L-I characteristics of light emitting diode (LED)
b) V-I Characteristics of solar cell
7. Determination of Energy gap of a semiconductor.
8. Determination of the resistivity of semiconductor by two probe method (Demonstration).
9. Study B-H curve of a magnetic material.
10. Determination of dielectric constant of a given material (Demonstration).
11. a) Determination of the beam divergence of the given LASER beam
b) Determination of Acceptance Angle and Numerical Aperture of an optical fiber.
12. Understanding the method of least squares – torsional pendulum as an example.

Note: Any 8 experiments are to be performed.

REFERENCE BOOK:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

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(R22HAS1128) ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY

The **English Language and Communication Skills (ELCS) Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives:

- ✓ To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
- ✓ To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
- ✓ To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
- ✓ To improve the fluency of students in spoken English and neutralize the impact of dialects.
- ✓ To train students to use language appropriately for public speaking, group discussions and interviews

Course Outcomes: Students will be able to:

- ✓ Understand the nuances of English language through audio-visual experience and group activities
- ✓ Neutralise their accent for intelligibility
- ✓ Speak with clarity and confidence which in turn enhances their employability skills

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:

- a. **Computer Assisted Language Learning (CALL) Lab**
- b. **Interactive Communication Skills (ICS) Lab**

Listening Skills:

Objectives

1. To enable students develop their listening skills so that they may appreciate the role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening, so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts
 - Oral practice
 - Describing objects/situations/people
 - Role play – Individual/Group activities
 - Just A Minute (JAM) Sessions

The following course content is prescribed for the **English Language and Communication Skills Lab**.

Exercise – ICALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening. *Practice:* Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs-Consonant Clusters- Past Tense Marker and Plural Marker- *Testing Exercises*

ICS Lab:

Understand: Spoken vs. Written language- Formal and Informal English.

Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave –Introducing Oneself and Others.

Exercise – IICALL Lab:

Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Stress pattern in sentences – Intonation.

Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Stress pattern in sentences – Intonation - *Testing Exercises*

ICS Lab:

Understand: Features of Good Conversation – Strategies for Effective Communication.

Practice: Situational Dialogues – Role Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise - IIICALL Lab:

Understand: Errors in Pronunciation-Neutralising Mother Tongue Interference (MTI).

Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation -*Testing Exercises*

ICS Lab:

Understand: Descriptions- Narrations- Giving Directions and Guidelines – Blog Writing

Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

Exercise – IVCALL Lab:

Understand: Listening for General Details.

Practice: Listening Comprehension Tests - *Testing Exercises*

ICS Lab:

Understand: Public Speaking – Exposure to Structured Talks - Non-verbal Communication-Presentation Skills.

Practice: Making a Short Speech – Extempore- Making a Presentation.

Exercise – VCALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests -*Testing Exercises*

ICS Lab:

Understand: Group Discussion

Practice: Group Discussion

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The **Computer Assisted Language Learning Lab** has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self-study by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

- i) Computers with Suitable Configuration
- ii) High Fidelity Headphones

2. Interactive Communication Skills (ICS) Lab :

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo –audio & video system and camcorder etc.

Source of Material (Master Copy):

- *Exercises in Spoken English. Part 1,2,3.* CIEFL and Oxford University Press

Note: Teachers are requested to make use of the master copy and get it tailor-made to suit the contents of the syllabus.

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
- Digital All
- Orell Digital Language Lab (Licensed Version)

REFERENCE BOOKS:

1. (2022). *English Language Communication Skills – Lab Manual cum Workbook.* Cengage Learning India Pvt. Ltd.
2. Shobha, KN & Rayen, J. Lourdes. (2019). *Communicative English – A workbook.* Cambridge University Press
3. Kumar, Sanjay & Lata, Pushp. (2019). *Communication Skills: A Workbook.* Oxford University Press
4. Board of Editors. (2016). *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities.*
Orient Black Swan Pvt. Ltd.
5. Mishra, Veerendra et al. (2020). *English Language Skills: A Practical Approach.* Cambridge University Press

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0	0	2	1

(R22CSE1129) C PROGRAMMING AND DATA STRUCTURES LABORATORY

Course Objectives: Introduce the importance of programming, C language constructs, program development, data structures, searching and sorting.

Course Outcomes:

1. Develop modular and readable C Programs
2. Solve problems using strings, functions
3. Handle data in files
4. Implement stacks, queues using arrays, linked lists.
5. To understand and analyze various searching and sorting algorithms

List of Experiments:

1. Write a C program to find the sum of individual digits of a positive integer.
2. 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 C program to generate the first n terms of the sequence.
3. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a C program to find the roots of a quadratic equation.
5. Write a C program to find the factorial of a given integer.
6. Write a C program to find the GCD (greatest common divisor) of two given integers.
7. Write a C program to solve Towers of Hanoi problem.
8. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use Switch Statement)
9. Write a C program to find both the largest and smallest number in a list of integers.
10. Write a C program that uses functions to perform the following:
 - i) Addition of Two Matrices
 - ii) Multiplication of Two Matrices
11. Write a C program that uses functions to perform the following operations:
 - i) To insert a sub-string in to a given main string from a given position.
 - ii) To delete n Characters from a given position in a given string.
12. Write a C program to determine if the given string is a palindrome or not
13. Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.
14. Write a C program to count the lines, words and characters in a given text.
15. Write a C program to generate Pascal's triangle.
16. Write a C program to construct a pyramid of numbers.
17. Write a C 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.)

18.
 - i. Write a C program which copies one file to another.
 - ii. Write a C program to reverse the first n characters in a file. (Note: The file name and n are specified on the command line.)
19.
 - i. Write a C program to display the contents of a file.
 - ii. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)
20. Write a C program that uses functions to perform the following operations on singly linked list.:
 - i) Creation
 - ii) Insertion
 - iii) Deletion
 - iv) Traversal
21. Write C programs that implement stack (its operations) using
 - i) Arrays
 - ii) Pointers
22. Write C programs that implement Queue (its operations) using
 - i) Arrays
 - ii) Pointers
23. Write a C program that implements the following sorting methods to sort a given list of integers in ascending order
 - i) Bubble sort
 - ii) Selection sort
 - iii) Insertion sort
24. Write C programs that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers:
 - i) Linear search
 - ii) Binary search

TEXT BOOKS:

1. C Programming & Data Structures, B.A. Forouzan and R. F. Gilberg, Third Edition, Cengage Learning.
2. Let us C, Yeswanth Kanitkar
3. C Programming, Balaguruswamy.

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B.Tech. - I Year – II Semester

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3	1	0	4

(R22MTH1211) ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

Course Objectives: To learn

- Methods of solving the differential equations of first and higher order.
- Concept, properties of Laplace transforms
- Solving ordinary differential equations using Laplace transforms techniques.
- The physical quantities involved in engineering field related to vector valued functions
- The basic properties of vector valued functions and their applications to line, surface and volume integrals

Course outcomes: After learning the contents of this paper the student must be able to

- Identify whether the given differential equation of first order is exact or not
- Solve higher differential equation and apply the concept of differential equation to real world problems.
- Use the Laplace transforms techniques for solving ODE's.
- Evaluate the line, surface and volume integrals and converting them from one to another

UNIT-I: First Order ODE

Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Applications: Orthogonal Trajectories (only in Cartesian Coordinates), Newton's law of cooling, Law of natural growth and decay.

UNIT-II: Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax} , \sin , $\cos ax$, polynomials in x , $e^{ax}V(x)$ and $x V(x)$, method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation. Applications: Electric Circuits both first and second order.

UNIT-III: Laplace transforms

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: Solving Ordinary Differential Equations with constant coefficient and with given initial conditions by Laplace Transform method.

UNIT-IV: Vector Differentiation

Vector point functions and scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Tangent plane and normal line, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration

Line, Surface and Volume Integrals, Theorems of Green, Gauss and Stokes (without proofs) and their applications.

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

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L	T	P	C
3	1	0	4

(R22CHE1112) ENGINEERING CHEMISTRY

Course Objectives:

1. To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.
2. To include the importance of water in industrial usage, fundamental aspects of battery chemistry, significance of corrosion it's control to protect the structures.
3. To imbibe the basic concepts of petroleum and its products.
4. To acquire required knowledge about engineering materials like cement, smart materials and Lubricants.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Acquire the basic knowledge of electrochemical procedures related to corrosion and its control.
2. Understand the basic properties of water and its usage in domestic and industrial purposes.
3. Learn the fundamentals and general properties of polymers and other engineering materials.
4. Predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.
5. Understand the synthesis of Synthetic petrol.

UNIT - I: Water and its treatment:

Introduction to hardness of water – Estimation of hardness of water by complexometric method and related numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and break - point chlorination. Defluoridation- Determination of F⁻ ion by ion- selective electrode method. Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods - Softening of water by ion- exchange processes. Desalination of water – Reverse osmosis.

UNIT – II Battery Chemistry & Corrosion

Introduction - Classification of batteries- primary, secondary and reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of: Zn-air and Lithium ion battery, Applications of Li-ion battery to electrical vehicles. Fuel Cells- Differences between battery and a fuel cell, Construction and applications of Methanol Oxygen fuel cell and Solid oxide fuel cell. Solar cells - Introduction and applications of Solar cells.

Corrosion: Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current methods.

UNIT - III: Polymeric materials:

Definition – Classification of polymers with examples – Types of polymerization – addition (free radical addition) and condensation polymerization with examples – Nylon 6:6, Terylene

Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC and Bakelite, Teflon, Fiber reinforced plastics (FRP). Rubbers: Natural rubber and its vulcanization.

Elastomers: Characteristics –preparation – properties and applications of Buna-S, Butyl and Thiokol rubber.

Conducting polymers: Characteristics and Classification with examples-mechanism of conduction intrans-polyacetylene and applications of conducting polymers.

Biodegradable polymers: Concept and advantages - Polylactic acid and poly vinyl alcohol and their applications.

UNIT - IV: Energy Sources:

Introduction, Calorific value of fuel – HCV, LCV- Dulong's formula. Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG, Biodiesel – Transesterification, advantages.

UNIT - V: Engineering Materials:

Cement: Portland cement, its composition, setting and hardening.

Smart materials and their engineering applications

Shape memory materials- Poly L- Lactic acid. Thermoresponse materials- Polyacryl amides, Poly vinyl amides

Lubricants: Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010
2. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, 2016
3. A text book of Engineering Chemistry by M. Thirumala Chary, E. Laxminarayana and K. Shashikala, Pearson Publications, 2021.
4. Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley Publications.

REFERENCE BOOKS:

1. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi (2011)

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1	0	4	3

(R22MED1125) COMPUTER AIDED ENGINEERING GRAPHICS

Course Objectives:

- To develop the ability of visualization of different objects through technical drawings
- To acquire computer drafting skill for communication of concepts, ideas in the design of engineering products

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

- Apply computer aided drafting tools to create 2D and 3D objects
- sketch conics and different types of solids
- Appreciate the need of Sectional views of solids and Development of surfaces of solids
- Read and interpret engineering drawings
- Conversion of orthographic projection into isometric view and vice versa manually and by using computer aided drafting

UNIT – I:

Introduction to Engineering Graphics: Principles of Engineering Graphics and their Significance, Scales – Vernier, Plain & Diagonal, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Involute, Introduction to Computer aided drafting – views, commands and conics

UNIT- II:

Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes. Computer aided orthographic projections – points, lines and planes

UNIT – III:

Projections of Regular Solids – Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Computer aided projections of solids – sectional views

UNIT – IV:

Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone, Development of surfaces using computer aided drafting

UNIT – V:

Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions. Conversion of orthographic projection into isometric view using computer aided drafting.

Text Books:

- 1.Engineering Drawing N.D. Bhatt / Charotar
- 2.Engineering Drawing and graphics Using AutoCAD Third Edition, T. Jeyapoovan, Vikas: S. Chand and company Ltd.

Reference Books:

- 1.Engineering Drawing, Basant Agrawal and C M Agrawal, Third Edition McGraw Hill
- 2.Engineering Graphics and Design, WILEY, Edition 2020
- 3.Engineering Drawing, M. B. Shah, B.C. Rane / Pearson.
- 4.Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford
- 5.Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

Note: - External examination is conducted in conventional mode and internal evaluation to be done by both conventional as well as using computer aided drafting.

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L	T	P	C
3	0	0	3

(R22MED1214) ENGINEERING MECHANICS

Course Objectives: The objectives of this course are to

- Explain the resolution of a system of forces, compute their resultant and solve problems using equations of equilibrium
- Perform analysis of bodies lying on rough surfaces.
- Locate the centroid of a body and compute the area moment of inertia and mass moment of inertia of standard and composite sections
- Explain kinetics and kinematics of particles, projectiles, curvilinear motion, centroidal motion and plane motion of rigid bodies.
- Explain the concepts of work-energy method and its applications to translation, rotation and plane motion and the concept of vibrations

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

- CO 1: Determine resultant of forces acting on a body and analyse equilibrium of a body subjected to a system of forces.
- CO 2: Solve problem of bodies subjected to friction.
- CO 3: Find the location of centroid and calculate moment of inertia of a given section.
- CO 4: Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotatory motion and rigid body motion.
- CO 5: Solve problems using work energy equations for translation, fixed axis rotation and plane motion and solve problems of vibration.

UNIT - I:

Introduction to Engineering Mechanics - Force Systems: Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

UNIT - II:

Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;
Centroid and Centre of Gravity -Centroid of Lines, Areas and Volumes from first principle, centroid of composite sections; Centre of Gravity and its implications. – Theorem of Pappus

UNIT - III:

Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Product of Inertia, Parallel Axis Theorem, Perpendicular Axis Theorem
Mass Moment of Inertia: Moment of Inertia of Masses - Transfer Formula for Mass Moments of Inertia – Mass moment of inertia of composite bodies.

UNIT - IV:

Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

UNIT - V:

Kinetics of Rigid Bodies -Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D' Alembert's principle and its applications in plane motion and connected bodies; Work Energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation

Text Books:

1. Shames and Rao (2006), Engineering Mechanics, Pearson Education
2. Reddy Vijay Kumar K. and J. Suresh Kumar (2010), Singer's Engineering Mechanics – Statics & Dynamics

Reference Books:

1. Beer F.P & Johnston E.R Jr., Vector Mechanics for Engineers – Statics and Dynamics, Mc Graw Hill, 12th Edition.
2. Dumir P.C, Sengupta, Srinivas, Engineering Mechanics- Universities Press, 2020.
3. Hibbeler R.C, Engineering Mechanics, Pearson, 14th Edition.
4. Arshad Noor, Zahid & Goel, Engineering Mechanics, Cambridge University Press, 2018.
5. Khurmi R.S, Khurmi N., Engineering Mechanics, S. Chand, 2020.
6. Basudeb Bhattacharyya, "Engineering Mechanics", Oxford University Press

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(R22MED1215) ENGINEERING MATERIALS

Course Objectives: The objectives of this course are to

1. Provide basic understanding of engineering materials, their structure, classification and usage.
2. Introduce the testing methods for various material properties and ASTM standards used in testing.
3. Understand the various materials used in mechanical engineering like metals, ceramics, polymers, composite materials and other new materials.

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

1. Classify the various materials that will be essential for the mechanical engineering applications.
2. Express the mechanical properties of metals and their testing procedures.
3. Understand the application of materials and their processing
4. Understand the materials fabrication methods
5. Understand the requirement and need for the development of the new materials.

UNIT-I:

Classification of Engineering Materials, Ashby chart, Mechanical Properties of Metals and their testing equipment/procedures, ASTM standards for testing, Stress–Strain Behavior of various materials, Sources of Material Data

UNIT –II:

Metals and Metal Alloys, Classification of Metal Alloys, Classification, composition, properties and usage of Ferrous alloys, steel, HSS, grey cast iron, white cast iron; Classification, composition, properties and usage of Non-ferrous materials, Aluminum, Titanium, Zinc, Copper, Nickel, Cobalt and their alloys

UNIT –III:

Composites: Definitions, Reinforcements and matrices, Types of reinforcements, Types of matrices, Classification of composites, Properties of composites in comparison with standard materials
Manufacturing methods: Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting and prepregs.

UNIT – IV:

Ceramics, Classification of ceramic materials, Crystal Structure, Applications and Properties of Ceramics, Ceramic fabrication techniques, Carbon: Diamond and Graphite.
Polymer Structures, Chemistry of Polymer Molecules, Classification scheme of polymer molecules, Thermoplastic and Thermosetting Polymers, Characteristics, Applications, and Processing of Polymers, Elastomers.

UNIT – V:

Materials in nano technology: Semiconductor Nanomaterials (Zinc oxide nano materials, titanium dioxide nanoparticles, Metal nanoparticles, ceramic nano materials metal nano particles (Silver, gold, iron and copper), applications, bio materials and other recent materials

Text Books:

1. George Murray, Charles V. White, Wolfgang Weise, “Introduction to Engineering Materials”, CRC Press, 2007.
2. William. D. Callister, David G. Rethwisch, “Materials Science and Engineering: An Introduction”, John Wiley & Sons, 2018.

Reference Books:

1. Myer Kutz, “Mechanical Engineers’ Handbook”, John Wiley & Sons, 2015.
2. M.A. Shah, K.A.Shah, Nano technology, the science of Small, WILEY, Second Edition, 2019.
3. E. Paul De Garmo, J.T. Black, R.A. Kohler. Materials and Processes in Manufacturing, JohnWiley and Sons, Inc., NY, 11 th Edition, 2012.
4. R.J. Crawford, plastics engineering, Pergamon Presss, 2013.
5. Donald R Askland and Pradeep P Phule “Essentials of Materials Science and Engineering”,by Pradeep P. Fulay (Author), Donald R. Askeland, 2013.
6. K. K. Chawala, Cermic Matrix composite Materials, Kluwer Academic Publishers, 2002.

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(R22CSE1227) PYTHON PROGRAMMING LABORATORY

Course Objectives:

- To install and run the Python interpreter
- To learn control structures.
- To Understand Lists, Dictionaries in python
- To Handle Strings and Files in Python

Course Outcomes: After completion of the course, the student should be able to

- Develop the application specific codes using python.
- Understand Strings, Lists, Tuples and Dictionaries in Python
- Verify programs using modular approach, file I/O, Python standard library
- Implement Digital Systems using Python

Note: The lab experiments will be like the following experiment examples

Week -1:

1. i) Use a web browser to go to the Python website <http://python.org>. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.
i) Start the Python interpreter and type help() to start the online help utility.
2. Start a Python interpreter and use it as a Calculator.
3.
i) Write a program to calculate compound interest when principal, rate and number of periods are given.
ii) Given coordinates (x1, y1), (x2, y2) find the distance between two points
4. Read name, address, email and phone number of a person through keyboard and print the details.

Week - 2:

1. Print the below triangle using for loop.
5
4 4
3 3 3
2 2 2 2
1 1 1 1 1
2. Write a program to check whether the given input is digit or lowercase character or upper case character or a special character (use 'if-else-if' ladder)
3. Python Program to Print the Fibonacci sequence using while loop
4. Python program to print all prime numbers in a given interval (use break)

Week - 3:

1. i) Write a program to convert a list and tuple into arrays.
ii) Write a program to find common values between two arrays.
2. Write a function called gcd that takes parameters a and b and returns their greatest common divisor.
3. Write a function called palindrome that takes a string argument and returns True if it is a palindrome and False otherwise. Remember that you can use the built-in function len to check the length of a string.

Week - 4:

1. Write a function called `is_sorted` that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.
2. Write a function called `has_duplicates` that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.
 - i). Write a function called `remove_duplicates` that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.
 - ii). The wordlist I provided, `words.txt`, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.
 - iii). Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.
3.
 - i) Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
 - ii) Remove the given word in all the places in a string?
 - iii) Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?
4. Writes a recursive function that generates all binary strings of n-bit length

Week - 5:

1.
 - i) Write a python program that defines a matrix and prints
 - ii) Write a python program to perform addition of two square matrices
 - iii) Write a python program to perform multiplication of two square matrices
2. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
3. Use the structure of exception handling all general purpose exceptions.

Week-6:

1.
 - a. Write a function called `draw_rectangle` that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.
 - b. Add an attribute named `color` to your Rectangle objects and modify `draw_rectangle` so that it uses the `color` attribute as the fill color.
 - c. Write a function called `draw_point` that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.
 - d. Define a new class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called `draw_circle` that draws circles on the canvas.
2. Write a Python program to demonstrate the usage of Method Resolution Order (MRO) in multiple levels of Inheritances.
3. Write a python code to read a phone number and email-id from the user and validate it for correctness.

Week- 7

1. Write a Python code to merge two given file contents into a third file.
2. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.
3. Write a Python code to Read text from a text file, find the word with most number of occurrences
4. Write a function that reads a file `file1` and displays the number of words, number of vowels, blankspaces, lower case letters and uppercase letters.

Week - 8:

1. Import numpy, Plotpy and Scipy and explore their functionalities.
2. a) Install NumPy package with pip and explore it.
3. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR

4. Write a program to implement Half Adder, Full Adder, and Parallel Adder
5. Write a GUI program to create a window wizard having two text labels, two text fields and twobuttons as Submit and Reset.

TEXT BOOKS:

1. Supercharged Python: Take your code to the next level, Overland
2. Learning Python, Mark Lutz, O'reilly

REFERENCE BOOKS:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Python Programming A Modular Approach with Graphics, Database, Mobile, and WebApplications, Sheetal Taneja, Naveen Kumar, Pearson
3. Programming with Python, A User's Book, Michael Dawson, Cengage Learning, India Edition
4. Think Python, Allen Downey, Green Tea Press
5. Core Python Programming, W. Chun, Pearson
6. Introduction to Python, Kenneth A. Lambert, Cengage

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(R22CHE1127) ENGINEERING CHEMISTRY LABORATORY

Course Objectives: The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:

- Estimation of hardness of water to check its suitability for drinking purpose.
- Students are able to perform estimations of acids and bases using conductometry, potentiometry method.
- Students will learn to prepare polymers such as Bakelite and nylon-6 in the laboratory.
- Students will learn skills related to the lubricant properties such as saponification value, surface tension and viscosity of oils.

Course Outcomes: The experiments will make the student gain skills on:

1. Determination of parameters like hardness of water and rate of corrosion of mild steel in various conditions.
2. Able to perform methods such as conductometry, potentiometry and pH metry in order to findout the concentrations or equivalence points of acids and bases.
3. Students are able to prepare polymers like bakelite and nylon-6.
4. Estimations saponification value, surface tension and viscosity of lubricant oils.

List of Experiments:

I. Volumetric Analysis:

1. Estimation of Hardness of water by Complexometry using EDTA .
2. Estimation of Fe⁺² by Dichrometry.
3. Estimation of Ferrous by Permanganometry.

II. Conductometry: Estimation of the concentration of an acid by Conductometry.

III. Potentiometry:

1. Estimation of the amount of Fe⁺² by Potentiometry.
2. Estimation of the concentration of an acid by Potentiometry.

IV. Preparations:

1. Preparation of Bakelite.
2. Preparation Nylon – 6.

V. Lubricants:

1. Estimation of acid value of given lubricant oil.
2. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.

VI. Virtual lab experiments

1. Construction of Fuel cell and its working.
2. Smart materials for Biomedical applications
3. Batteries for electrical vehicles.
4. Functioning of solar cell and its applications.

REFERENCE BOOKS:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)
2. Vogel's text book of practical organic chemistry 5th edition
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).

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(R22MED1228) FUELS AND LUBRICANTS LABORATORY

Course Objectives: To Understand the fuel and lubricants properties.

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

1. Find the kinematic viscosity of lubricants and its variation with temperature
2. Determine the flash point, fire point, cloud point and pour point of liquid fuels
3. Determine the calorific value of solid, liquid and gaseous fuels
4. Determination of the dropping point of lubricating grease
5. Determination of distillation characteristics of petroleum products

List of Experiments:

1. Determination of Flash and Fire points of Liquid fuels/Lubricants using: Abels Apparatus
2. Determination of Flash and Fire points of Liquid fuels/Lubricants using: Pensky Martens Apparatus
3. Carbon residue test: Liquid fuels.
4. Determination of Viscosity of Liquid lubricants and Fuels using: Saybolt Viscometer
5. Determination of Viscosity of Liquid lubricants and Fuels using: Redwood Viscometer
6. Determination of Viscosity of Liquid lubricants and Fuels using: Engler Viscometer
7. Determination of Calorific value: of Gaseous fuels using: Junkers Gas Calorimeter.
8. Determination of Calorific value: Solid/Liquid/ fuels using: Bomb Calorimeter.
9. Drop point and Penetration Apparatus for Grease.
10. ASTM Distillation Test Apparatus.

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(R22MTH2113) PROBABILITY, STATISTICS & COMPLEX VARIABLES

Course Objectives: To learn

- The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
- The basic ideas of statistics including measures of central tendency, correlation and regression.
- The statistical methods of studying data samples.
- Differentiation and integration of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
- Expansion of complex functions using Taylor's and Laurent's series.

Course outcomes: After learning the contents of this paper the student must be able to

- Formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data.
- Apply concept of estimation and testing of hypothesis to case studies.
- Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.
- Taylor's and Laurent's series expansions of complex function.

UNIT-I: Basic Probability

Probability spaces, conditional probability, independent events, and Baye's theorem.

Random variables: Discrete and continuous random variables, Expectation of Random Variables, Variance of random variables

UNIT-II: Probability distributions

Binomial, Poisson, evaluation of statistical parameters for these distributions, Poisson approximation to the binomial distribution, Continuous random variables and their properties, distribution functions and density functions,

Normal and exponential, evaluation of statistical parameters for these distributions

UNIT-III: Estimation & Tests of Hypotheses

Introduction, Statistical Inference, Classical Methods of Estimation.: Estimating the Mean, Standard Error of a Point Estimate, Prediction Intervals, Estimating a Proportion for single sample, Difference between Two Means, difference between two proportions for two Samples.

Statistical Hypotheses: General Concepts, Testing a Statistical Hypothesis, Tests Concerning a Single Mean, Tests on Two Means, Test on a Single Proportion, Two Samples: Tests on Two Proportions.

UNIT-IV: Complex Differentiation

Limit, Continuity and Differentiation of Complex functions, Analyticity, Cauchy-Riemann equations (without proof), finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties, Conformal mappings, Mobius transformations.

UNIT-V: Complex Integration

Line integral, Cauchy's theorem, Cauchy's Integral formula, Zeros of analytic functions, Singularities, Taylor's series, Laurent's series, Residues, Cauchy Residue theorem (All theorems without Proof).

Text books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, keying Ye, Probability and statistics for engineers and scientists, 9th Edition, Pearson Publications.

Reference books:

1. Fundamentals of Mathematical Statistics, Khanna Publications, S. C. Guptha and V.K.Kapoor.
2. Miller and Freund's, Probability and Statistics for Engineers, 8th Edition, Pearson Educations.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edition, Mc-Graw Hill, 2004.

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(R22MED2112) MECHANICS OF SOLIDS

Course Objectives: The objectives of this course are to:

1. Understand the concepts of internal forces, moments, stress, strain, and deformation of solids with applications to bars, beams, and columns.
2. Learn the fundamentals of applying equilibrium, compatibility, and force-deformation relationships to structural elements.
3. Study twisting of circular bars and hollow shafts acted on by torsional moments.
4. Define the state of stress at a point on a body and to develop stress transformations.
5. Introduce the concept of theories of elastic failure and their significance in the design.

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

1. Evaluate the internal forces, moments, stresses, strains, and deformations in structures made of various materials acted on by a variety of loads.
2. Draw axial force, shear force and bending moment diagrams for beams and frames.
3. Develop the Bending and Torsion formula and apply to the design of beams and shafts.
4. Use the stress transformation equations to find the state of stress at a point for various rotated positions of the stress element and display the same in graphical form as Mohr's circle.
5. Understand the different criteria for the safety of the component by applying the theories of elastic failure.

UNIT – I:

Simple Stresses & Strains: Elasticity and plasticity – Types of stresses & strains – Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II:

Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III:

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT – IV:

Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

Theories of Failure: Introduction – Various theories of failure - Maximum Principal Stress Theory, Maximum Principal Strain Theory, Strain Energy and Shear Strain Energy Theory (Von Mises Theory).

UNIT – V:

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: $T/J = q/r = N\theta/L$ – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Columns and Struts: Euler's Theory, Limitations of Euler's theory, Equivalent Length, Rankine's Formula, Secant Formula.

Text Books:

1. Barry J. Goodno and James M. Gere, "Mechanics of Materials" Ninth Edition, Cengage Learning, 2018.
2. S. S. Rattan, "Strength of Materials", Second Edition Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2011

Reference Books:

1. U. C. Jindal, "Strength of Materials", Pearson Education India, 2012
2. Egor P. Popov, Toader A. Balan, "Engineering Mechanics of Solids", PHI Learning, 2010
3. G. H. Ryder, "Strength of Materials", Macmillan Long Man Publications, 1961
4. W. A. Nash and M. C. Potter, "Strength of Materials", Fifth Edition, Schaum's Outline Series, 2011

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(R22MED2113) METALLURGY & MATERIAL SCIENCE

Course Objectives: Students will be able to

1. Learn the concepts of metallurgy and materials science in manufacturing processes.
2. Interpret phase diagrams of different alloy systems.
3. Describe the concept of heat treatment and other strengthening mechanisms.

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

1. Memorize the types of Crystal structures and their defects.
2. Learn the necessity of alloying and identify types of alloy phases.
3. Demonstrate importance of critical understanding of heat treatment in achieving required properties.
4. Apply the knowledge of heat treatment to enhance surface properties.
5. Analyze the properties and micro structure of ferrous and non-ferrous alloys.
6. Develop new materials and enhance properties for the advanced applications.

UNIT – I

Crystal Structure: Unit cells, Metallic and Ceramic crystal structures. Imperfection in solids: Point, line, surface and volume defects; dislocations, strengthening mechanisms, slip systems, critical resolved shear stress.

UNIT – II

Hume – Rothery Rules: Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, Eutectoid, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstructural aspects of ledeburite, austenite, pearlite, ferrite and cementite.

UNIT –III

Heat treatment of steels: Isothermal transformation diagrams for Fe-C alloys and microstructures development. Martensite, Bainite. Annealing, Normalising, Hardening, Tempering and Spheroidising.

UNIT – IV

Continuous cooling curves and interpretation of final microstructures and properties-Thermo mechanical treatments like austempering, martempering, surface hardening methods like case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening

UNIT – V

Alloy steels, properties and applications of stainless steels and tool steels, maraging steels- Types of cast irons (grey, white, malleable and spheroidal graphite cast irons), copper and its alloys (Brass and bronze)- Aluminium and its alloys (Al-Cu Alloys). Ceramics and Composites: Types, properties and applications.

TEXT BOOKS:

1. V. Raghavan, "Material Science and Engineering", Prentice Hall of India Private Limited, Fifth Edition.
2. William. D. Callister, David G. Rethwisch, "Materials Science and Engineering: An Introduction", John Wiley & Sons, 2018.
3. SIDNEY H AVNER, Introduction to Physical Metallurgy, McGraw Hill, 2017

REFERENCE BOOKS:

1. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 9th Edition, Indian Reprint, 2009.
2. U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011.

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(R22MED2114) PRODUCTION TECHNOLOGY

Course Objectives:

- To expose the students to understand the concept of basic casting processes & furnaces.
- To provide a technical understanding of various joining processes used in the manufacturing industry.
- To impart the students to the concepts of solid-state welding processes.
- To teach the concepts of rolling and various press working operations.
- To provide a technical understanding of different metal forming processes like extrusion, forging and high energy rate forming processes.

Course Outcomes: Student will be able to:

1. Elaborate the fundamentals of various moulding, casting techniques and furnaces.
2. Identify the importance of permanent joining and principle behind different welding processes.
3. Explain the concepts of solid-state welding processes
4. Understand the concepts of rolling and sheet metal operations in metal working.
5. Elaborates the uniqueness of extrusion, forging and high energy rate forming processes in metal working.

UNIT – I:

Casting: Steps involved in making a casting – Advantage of casting and its applications; Patterns - Pattern making, Types, Materials used for patterns, pattern allowances; Properties of moulding methods. Methods of Melting - Crucible melting and cupola operation – Defects in castings; Principles of Gating – Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design. Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding

UNIT – II:

Welding: Classification – Types of welds and welded joints and their characteristics, Welding Positions - Gas welding - Types, oxy-fuel gas cutting – standard time and cost calculations. Arc welding, Shielded metal arc welding, submerged arc welding, Resistance welding, Thermit welding.

UNIT – III:

Inert Gas Welding _ TIG Welding, MIG welding, Friction welding, Friction Stir Welding, induction welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non- destructive testing of welds.

UNIT – IV:

Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth. Sheet metal Operations: Stamping, Blanking and piercing, Coining, Strip layout, Hot and cold spinning – Bending and deep drawing. Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements. Drawing and its types – wire drawing and Tube drawing – Types of presses and press tools. Forces and power requirement in the above operations.

UNIT – V:

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion, Hydrostatic extrusion. Forces in extrusion

Forging Processes: Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

High Energy Rate Forming Processes: Principles of Explosive Forming, Electro-hydraulic Forming, Electro-magnetic forming and rubber pad Forming.

TEXT BOOKS:

1. Manufacturing Technology / P.N. Rao/ Vol.1 / Mc Graw Hill Education/ 5th Edition, 2018.
2. Manufacturing Engineering & Technology / Serope Kalpakjian / Steven R. Schmid / Pearson, 7th Edition, 2014

REFERENCE BOOKS:

1. Production Technology Vol.: 1, WILEY, sreeramulu M, 2018
2. A Text book of Production Technology (Manufacturing Processes) / Dr.P.C. Sharma / S.Chand Publications / 1st Edition, 2006.
3. Manufacturing processes H. S. Shan, Second Edition, Cambridge University Press, 2017.
4. Production Technology: Manufacturing Processes, Technology and Automation / R. K. Jain / Vol.1/Khanna Publishers / 19th Edition, 2009.
5. Elements of Workshop Technology/ S.K. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy/Vol.1/ Media Publishers & Promoters Pvt. Ltd./1st Edition, 2008.

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(R22MED2115) THERMODYNAMICS

Course Objective: To understand the treatment of classical Thermodynamics and to apply the First and Second laws of Thermodynamics to engineering applications

Course Outcomes: At the end of the course, the student should be able to

1. Understand the basics of Thermodynamics
2. Apply first and second laws of thermodynamics to different systems
3. Determine the feasibility of a process w.r.to entropy changes
4. Apply concepts of thermodynamic property relations to ideal gas and real gases
5. Evaluate performance of power cycles and refrigeration cycles

Tables/Codes: Steam Tables and Mollier Chart, Refrigeration Tables

UNIT – I:

Introduction: Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale

UNIT – II:

PMM I - Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation.

Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics

UNIT – III:

Pure Substances, p-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes

UNIT – IV:

Deviations from perfect Gas Model – Vander Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables

Mixtures of perfect Gases – Mole Fraction, Mass fraction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air – Psychrometric Properties –

Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation, Carrier's Equation – Psychrometric chart.

UNIT – V:

Power Cycles: Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles, Brayton and Rankine cycles – Performance Evaluation.

Refrigeration Cycles: Bell-Coleman cycle, Vapour compression cycle-performance Evaluation.

Text books:

1. Engineering Thermodynamics / PK Nag / Mc Graw Hill
2. Thermodynamics – An Engineering Approach by Yunus A. Cengel & Michael A. Boles, TMH
3. Fundamentals of Classical Thermodynamics by G. Van Wylan & R.E. Sonntag, John Wiley Pub

Reference Books:

1. Engineering Thermodynamics by Jones & Dugan, PHI, 2007.
2. Thermodynamics by M. Achutan, PHI, 2nd Edition, 2013.
3. Thermodynamics & Heat Engines by R. Yadav, Central Book Depot, Allahabad.
4. Thermodynamics by S.C. Gupta, Pearson Publications.

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B.Tech. - II Year – I Semester

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(R22MED2126) PRODUCTION TECHNOLOGY LABORATORY

Course Objectives:

1. Know about the basic Physical, Chemical Properties of materials
2. Learn the basic operation of various manufacturing processes
3. Design and fabricate a simple product

Course Outcomes: After completion of the course, the student will be able to

1. Analyze the given problem and conducts investigation on the experimental setup.
2. Operate different types of welding machines
3. Perform operations on mechanical press.
4. get familiarity with processing of Plastics.
5. Effectively communicate and explain the experimental analysis.

Minimum of 12 Exercises need to be performed

I. Metal Casting Lab:

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1
3. Moulding Melting and Casting - 1 Exercise

II. Welding Lab:

1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

III. Mechanical Press Working:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.
3. Bending and other operations

IV. Processing of Plastics

1. Injection Moulding
2. Blow Moulding

REFERENCE BOOK:

1. Dictionary of Mechanical Engineering – G.H.F. Naylor, Jaico Publishing House

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(R22MED2127) MATERIAL SCIENCE & MECHANICS OF SOLIDS LABORATORY

Course Objective: The Objective is to make the students to learn the concepts of Metallurgy and Material Science in manufacturing processes, which convert raw materials into useful products. Students will be able to understand basic structure and crystal arrangements of materials and classify and distinguish different microstructures of steels, cast irons and non-ferrous alloys.

Course Outcomes: At the end of the lab, the student will be able to

1. Design different crystal structures and their models and the microstructures developed for different ferrous and non-ferrous metals.
2. Correlate the microstructures, properties, performance and processing of alloys.
3. Analyze the behavior of the solid bodies subjected to various types of loading and Apply knowledge of materials and structural elements to the analysis of simple structures.
4. Undertake problem identification, formulation and solution using a range of analytical methods
5. Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams. Expectation and capacity to undertake lifelong learning.

List of Experiments:

1. Preparation and study of crystal models for simple cubic, body centred cubic, face centred cubic and hexagonal close packed structures.
2. Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.
3. Preparation and study of the Microstructure of Mild steels, low carbon steels, high Carbon steels.
4. Study of the Microstructures of Various Cast Irons.
5. Study of the Microstructures of Non-Ferrous alloys. (Al, Cu, Mg)
6. Hardenability of steels by Jominy End Quench Test.

MECHANICS OF SOLIDS LAB:

Course Objectives: The objective is to learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns. Detailed study of engineering properties of materials is also of interest. Fundamentals of applying equilibrium, compatibility, and force-deformation relationships to structural elements are emphasized. The students are introduced to advanced concepts of flexibility and stiffness method of structural analysis. The course builds on the fundamental concepts of engineering mechanics course.

Course Outcomes: At the end of the lab, the student will be able to:

- Analyze the behavior of the solid bodies subjected to various types of loading.
- Apply knowledge of materials and structural elements to the analysis of simple structures.
- Undertake problem identification, formulation and solution using a range of analytical methods
- Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams.
- Expectation and capacity to undertake lifelong learning.

List of Experiments:

1. Direct tension test
2. Bending test on Simple supported beam
3. Bending test on Cantilever beam
4. Torsion test
5. Brinell hardness test/ Rockwell hardness test
6. Test on springs
7. Izod Impact test/ Charpy Impact test

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(R22MED2129) **COMPUTER AIDED MACHINE DRAWING**

Course objectives: To familiarize with the standard conventions for different materials and machine parts in working drawings. To make part drawings including sectional views for various machine elements. To prepare assembly drawings given the details of part drawings.

Course Outcomes:

1. Preparation of engineering and working drawings with dimensions and bill of material during design and development. Developing assembly drawings using part drawings of machine components.
2. Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
3. Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
4. Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
5. Title boxes, their size, location and details - common abbreviations and their liberal usage
6. Types of Drawings – working drawings for machine parts.

Drawing of Machine Elements and simple parts

Selection of Views, additional views for the following machine elements and parts with every drawing proportion.

1. Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
2. Keys, cottered joints and knuckle joint.
3. Rivetted joints
4. Shaft coupling, spigot and socket pipe joint.
5. Journal, pivot and collar and foot step bearings.

Drawing of Machine Elements: Using Computer aided drafting in addition to manual drawing

Assembly Drawings:

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

1. Steam engine parts – stuffing box, cross head, Eccentric.
2. Machine tool parts: Tail stock, Tool Post, Machine Vices.
3. Other machine parts - Screw jack, Connecting rod, Plumber block, Fuel Injector
4. Valves - Steam stop valve, spring loaded safety valve, feed check valve and air cock.

Assembly Drawings: Using Computer aided drafting in addition to manual drawing

- NOTE:**
1. First angle projection to be adopted.
 2. All the drawing components/Assembly to be drawn using any Computer aided drafting package

TEXT BOOKS:

1. Machine Drawing / N.D. Bhatt / Charotar
2. Machine Drawing with Auto CAD / Goutham Pohit, Goutam Ghosh / Pearson

REFERENCE BOOKS:

1. Machine Drawing by / Bhattacharyya / Oxford
2. Machine Drawing / Ajeet Singh / Mc Graw Hill

Note: - **External examination is conducted in conventional mode and internal evaluation to be done by both conventional as well as using computer aided drafting.**

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B.Tech. - II Year – I Semester

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(R22MAC2110) CONSTITUTION OF INDIA

Course Objectives: Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution
4. Discuss the passage of the Hindu Code Bill of 1956.

Unit - 1 History of Making of the Indian Constitution- History of Drafting Committee.

Unit - 2 Philosophy of the Indian Constitution- Preamble Salient Features

Unit - 3 Contours of Constitutional Rights & Duties - Fundamental Rights

- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit - 4 Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

Unit - 5 Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit - 6 Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Reading:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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B.Tech. - II Year – II Semester

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(R22EEE2211) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Course Objectives:

1. To introduce the concepts of electrical circuits and its components
2. To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
3. To study and understand the different types of DC/AC machines and Transformers.
4. To impart the knowledge of various electrical installations.
5. To introduce the concept of power, power factor and its improvement.
6. To introduce the concepts of diodes & transistors, and
7. To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:

1. To analyze and solve electrical circuits using network laws and theorems.
2. To understand and analyze basic Electric and Magnetic circuits
3. To study the working principles of Electrical Machines
4. To introduce components of Low Voltage Electrical Installations
5. To identify and characterize diodes and various types of transistors.

UNIT - I:

D.C. Circuits: Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation.

A.C. Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits, Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT - II:

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

UNIT - III:

Electrical Machines: Working principle of Single-phase transformer, equivalent circuit, losses in transformers, efficiency, Three-phase transformer connections. Construction and working principle of DC generators, EMF equation, working principle of DC motors, Torque equations and Speed control of DC motors, Construction and working principle of Three-phase Induction motor, Torques equations and Speed control of Three-phase induction motor. Construction and working principle of synchronous generators.

UNIT - IV:

P-N Junction and Zener Diode: Principle of Operation Diode equation, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Zener diode characteristics and applications.

Rectifiers and Filters: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters, π - section Filters.

UNIT - V:

Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations.

Field Effect Transistor (FET): Construction, Principle of Operation, Comparison of BJT and FET, Biasing FET.

TEXT BOOKS:

1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education

REFERENCE BOOKS:

1. Electronic Devices and Circuits – R. L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabrata Jit, TMH, 2/e, 1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
4. Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2nd edition by Raymond A. De Carlo and Pen-Min-Lin, Oxford University Press-2004.
5. Network Theory by N. C. Jagan & C. Lakshminarayana, B.S. Publications.
6. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
7. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
8. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
9. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

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(R22MED2212) KINEMATICS OF MACHINERY

Course Objectives: The objectives of this course are

1. To introduce the concept of machines, mechanisms and related terminologies and the relative motion, velocity, and accelerations of the various elements in a mechanism.
2. To make the students become familiar with the most commonly used mechanisms such as four bar/slider crank/double slider crank mechanisms and their inversions.
3. To provide an overview of straight-line motion mechanisms, steering mechanisms and Hooke's joint.
4. To familiarize higher pairs like cams and principles of cams design.
5. To understand the kinematic analysis of gears & gear trains.

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

1. Understand the various elements in mechanism and the inversions of commonly used mechanisms such as four bar, slider crank and double slider crank mechanisms.
2. Draw the velocity and acceleration polygons for a given configuration of a mechanism.
3. Understand the conditions for straight line motion mechanisms, steering mechanism and the usage of Hooke's joint.
4. Draw the displacement diagrams and cam profile diagram for followers executing different types of motions and various configurations of followers.
5. Calculate the number of teeth and velocity ratio required for a given combination of gears.

UNIT – I:

Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully and incompletely constrained.

Mechanism and Machines – Mobility of Mechanisms: Grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage.

UNIT – II:

Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.

Plane motion of body: Instantaneous center of rotation- centrodes and axodes – Three centers in line theorem – Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method. Kliens construction - Coriolis acceleration - determination of Coriolis component of acceleration

Analysis of Mechanisms: Analysis of slider crank chain for displacement- velocity and acceleration of slider – Acceleration diagram for a given mechanism.

UNIT – III:

Straight-line motion mechanisms: Exact and approximate copied and generated types – Peaucellier - Hart - Scott Russel – Grasshopper – Watt -Tchebicheff's and Robert Mechanism - Pantographs

Steering gears: Conditions for correct steering – Davis Steering gear, Ackerman's steering gear.

Hooke's Joint: Single and double Hooke's joint –velocity ratio – application – problems.

UNIT – IV:

Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Analysis of motion of followers: Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

UNIT – V:

Higher pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding

Forms of teeth, cycloidal and involutes profiles – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements– Introduction to Helical – Bevel and worm gearing

Gear Trains: Introduction – Types – Simple – compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box - Differential gear for an automobile.

TEXT BOOKS:

1. Rattan, S.S, “Theory of Machines”, 4th Edition, Tata McGraw-Hill, 2014.
2. Uicker, J.J., Pennock G.R and Shigley, J.E., “Theory of Machines and Mechanisms”, 4 thEdition, Oxford University Press, 2014.

REFERENCE BOOKS:

1. Sadhu Sigh, “Theory of Machines”, Third Edition, Pearson Education, 2012.
2. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
3. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
4. Rao. J.S. and Dukkipati. R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., NewDelhi, 1992.

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(R22MED2213) FLUID MECHANICS & HYDRAULIC MACHINES

Course Objectives: To enable the student:

1. To understand the basic principles of fluid mechanics
2. To identify various types of flows
3. To understand boundary layer concepts and flow through pipes
4. To evaluate the performance of hydraulic turbines
5. To understand the functioning and characteristic curves of pumps

Course Outcomes:

1. Able to explain the effect of fluid properties on a flow system.
2. Able to identify type of fluid flow patterns and describe continuity equation.
3. To analyze a variety of practical fluid flow and measuring devices and utilize Fluid Mechanics principles in design.
4. To select and analyze an appropriate turbine with reference to given situation in power plants.
5. To estimate performance parameters of a given Centrifugal and Reciprocating pump.
6. Able to demonstrate boundary layer concepts.

UNIT – I:

Fluid statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity, and surface tension - vapour pressure and their influence on fluid motion- atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT – II:

Fluid kinematics: Stream line, path line and streak lines and stream tube, classification of flows- steady & unsteady, uniform & non-uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three-dimensional flows.

Fluid dynamics: Surface and body forces –Euler’s and Bernoulli’s equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT – III:

Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

Closed conduit flow: Reynold’s experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: Pitot tube, venturi meter, and orifice meter, Flow nozzle

UNIT – IV:

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory- functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT – V:

Centrifugal pumps: Classification, working, work done – barometric head- losses and efficiencies specific speed- performance characteristic curves, NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

TEXT BOOKS:

1. Hydraulics, Fluid mechanics and Hydraulic Machinery - MODI and SETH, 21st Edition, standard Book House.
2. Fluid Mechanics and Hydraulic Machines by Er. R. K. Rajput, S. Chand, 2019.

REFERENCE BOOKS:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria & Sons, 2018
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International publishers
Hydraulic Machines by T.R. Banga & S.C. Sharma, 7th Edition, Khanna Publishers

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(R22MED2214) IC ENGINES & GAS TURBINES

Course Objective:

1. Explain the Components of IC Engines and systems.
2. Analyze the stages of combustion to improve the performance of IC engines with respect to fuel economy and control of emissions in global, environmental and social context.
3. Understand and evaluate the performance analysis of the major components and systems of IC engines and their applications.
4. Explore the components and working principles of rotary, reciprocating, dynamic and axial compressors.
5. Understand the significance of gas turbines in real context in power generation.

Course Outcomes: At the end of the course, the student should be able to

1. Elaborate the working principles of IC Engine systems and its classification.
2. Explore the combustion stages of SI and CI engines, and factors influence for better combustion.
3. Evaluate the testing and performance parameters of IC engines.
4. Explain the function and working principles of rotary, reciprocating, dynamic axial compressors.
5. Understand the working principle of gas turbine and its classification with thermodynamic analysis.

UNIT – I:

I.C. Engines: Classification - Working principles of Four & Two stroke engine, SI & CI engines, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry.

UNIT – II:

Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect of engine variables – Abnormal combustion, pre-ignition and knocking in SI Engines – Fuel requirements and fuel rating, anti-knock additives – combustion chamber – requirements, types of SI engines.

Four stages of combustion in CI engines – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence in Diesel engine – open and divided combustion chambers and fuel injection– Diesel fuel requirements and fuel rating

UNIT – III:

Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart

Classification of compressors – Fans, blowers and compressors – positive displacement and dynamic types – reciprocating and rotary types.

Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, under cooling, saving of work, minimum work condition for staged compression

UNIT – IV:

Rotary Compressor (Positive displacement type): Roots Blower, vane sealed compressor, mechanical details and principle of working – efficiency considerations.

Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.

UNIT – V:

Gas Turbines: Simple Gas Turbine Plant – Ideal Cycle – Closed Cycle and Open Cycle for Gas Turbines, Constant Pressure Cycle, Constant Volume Cycle, Efficiency – Work Ratio and Optimum Pressure Ratio for Simple Gas Turbine Cycle. Parameters of Performance, Actual Cycle.

TEXT BOOKS:

1. I.C. Engines, V. Ganesan, 4th Edition, Mc Graw Hill
2. Thermal Engineering, Mahesh M Rathore, Tata Mc Graw Hill, 2010

REFERENCE BOOKS:

1. Applied Thermodynamics for Engineering Technologists, Eastop & McConkey, Pearson
2. Fundamentals of Classical Thermodynamics, Vanwylen G.J., Sonntag R.E., Wiley Eastern
3. Internal Combustion Engines Fundamentals, John B. Heywood, McGraw Hill Ed.

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B.Tech. - II Year – II Semester

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(R22MED2215) INSTRUMENTATION AND CONTROL SYSTEMS

Course Objectives:

1. To impart the basic knowledge of the functional blocks of measurement systems.
2. To provide technical understanding of various Temperature and pressure measuring instruments.
3. To expose the students to know the working of various physical variable Level, Flow, Speed and Acceleration measuring instruments.
4. To understand the working of various physical and Electrical variables Stress, Humidity, Force, Torque and Power measuring instruments.
5. To understand the concept of control system and calculate transfer functions of mechanical and translational systems with different techniques.

Course Outcome: After completion of the course, the student will be able to:

1. Know the basic knowledge of the functional blocks of measurement systems.
2. Describe the working of various physical variable Temperature and pressure measuring instruments.
3. Explain the working of various physical variable Level, flow, Speed and Acceleration measuring instruments.
4. Understand the working of various physical and Electrical variables Stress, Humidity, Force, Torque and Power measuring instruments.
5. Understand the concept of control system and calculate transfer functions of mechanical and translational systems with different techniques.

UNIT – I:

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional description of measuring instruments – examples. Static and Dynamic performance characteristics – sources of errors, Classification and elimination of errors. Measurement of Displacement: Theory and construction of various transducers to measure displacement – Using Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers; Calibration procedures.

UNIT – II:

Measurement of Temperature: Various Principles of measurement-Classification: Expansion Type: Bimetallic Strip- Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer; Changes in Chemical Phase: Fusible Indicators and Liquid crystals. Measurement of Pressure: Different principles used- Classification: Manometers, Dead weight pressure gauge Tester (Piston gauge), Bourdon pressure gauges, Bulk modulus pressure gauges, Bellows, Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges, ionization pressure gauges, McLeod pressure gauge.

UNIT – III:

Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators –Bubbler level indicators.

Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flowmeter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non-contact type Stroboscope; Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle- Piezo electric accelerometer.

UNIT – IV:

Stress-Strain measurements: Various types of stress and strain measurements – Selection and installation of metallic strain gauges; electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending, compressive and tensile strains – Temperature compensation techniques, Use of strain gauges for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter. Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT – V:

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems- Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems- Transfer functions- First and Second order mechanical systems

TEXT BOOKS:

1. Principles of Industrial Instrumentation & Control Systems/Chennakesava R alaavala, -Cengage Learning/1st Edition, 2009.
2. Basic Principles – Measurements (Instrumentation) & Control Systems /S. Bhaskar/ Anuradha Publications

REFERENCE BOOKS:

1. Measurement Systems: Applications & design, E. O. Doebelin, TMH, Tata Mcgraw Hill/6th Edition, 2017.
2. Instrumentation, Measurement & Analysis, B.C. Nakra & K.K. Choudhary, TMH, 4th Edition, 2016.
3. Experimental Methods for Engineers / Holman
4. Mechanical and Industrial Measurements / R. K. Jain/ Khanna Publishers.
5. Mechanical Measurements / Sirohi and Radhakrishna / New Age International, 3rd Edition, 2013.

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B.Tech. - II Year – II Semester

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(R22EEE2226) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

Course Objectives:

1. To introduce the concepts of electrical circuits and its components
2. To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
3. To study and understand the different types of DC/AC machines and Transformers.
4. To impart the knowledge of various electrical installations.
5. To introduce the concept of power, power factor and its improvement.
6. To introduce the concepts of diodes & transistors, and
7. To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:

1. To analyze and solve electrical circuits using network laws and theorems.
2. To understand and analyze basic Electric and Magnetic circuits
3. To study the working principles of Electrical Machines
4. To introduce components of Low Voltage Electrical Installations
5. To identify and characterize diodes and various types of transistors.

List of Experiments/ Demonstrations:

PART A: ELECTRICAL

1. Verification of KVL and KCL
2. (i) Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
(ii) Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star) in a Three Phase Transformer
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. Performance Characteristics of a Separately Excited DC Shunt Motor
5. Performance Characteristics of a Three-phase Induction Motor
6. No-Load Characteristics of a Three-phase Alternator

PART B: ELECTRONICS

1. Study and operation of
(i) Multi-meters (ii) Function Generator (iii) Regulated Power Supplies (iv) CRO.
2. PN Junction diode characteristics
3. Zener diode characteristics and Zener as voltage Regulator
4. Input & Output characteristics of Transistor in CB / CE configuration
5. Full Wave Rectifier with & without filters
6. Input and Output characteristics of FET in CS configuration

TEXT BOOKS:

1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education

REFERENCE BOOKS:

1. Electronic Devices and Circuits – R. L. Boylestead and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabrata Jit, TMH, 2/e, 1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
4. Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2nd edition by Raymond A. De Carlo and Pen-Min-Lin, Oxford University Press-2004.
5. Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
6. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
7. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
8. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
9. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989

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(R22MED2227) FLUID MECHANICS & HYDRAULIC MACHINES LABORATORY

Course Objectives:

1. To understand the basic principles of fluid mechanics.
2. To identify various types of flows.
3. To understand boundary layer concepts and flow through pipes.
4. To evaluate the performance of hydraulic turbines.
5. To understand the functioning and characteristic curves of pumps.

Course Outcomes:

1. Able to explain the effect of fluid properties on a flow system.
2. Able to identify type of fluid flow patterns and describe continuity equation.
3. To analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.
4. To select and analyze an appropriate turbine with reference to given situation in power plants.
5. To estimate performance parameters of a given Centrifugal and Reciprocating pump.
6. Able to demonstrate boundary layer concepts

List of Experiments:

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Verification of Bernoulli's Theorems.

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(R22MED2228) INSTRUMENTATION AND CONTROL SYSTEMS LABORATORY

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

1. Characterize and calibrate measuring devices.
2. Identify and analyze errors in measurement.
3. Analyze measured data using regression analysis.
4. Calibration of Pressure Gauges and temperature
5. Calibration of LVDT, capacitive transducer and rotameter.

List of Experiments:

1. Calibration of Pressure Gauges.
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for temperature measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotameter for flow measurement.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of McLeod gauge for low pressure.
12. Effect of P, PI, PID, PD controller on a second order system.
13. Lag and Lead compensation.
14. Characteristics of Synchros.

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(R22MED2269) REAL-TIME RESEARCH PROJECT/ FIELD-BASED PROJECT

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(R22MAC2120) GENDER SENSITIZATION LAB

COURSE DESCRIPTION

This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality.

This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender-based violence on education, health and development.

Objectives of the Course

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Learning Outcomes

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labor and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

Unit-I: UNDERSTANDING GENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

Unit – II: GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences- Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary

Unit – III: GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- “My Mother doesn’t Work.” “Share the Load.”-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work.

-Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

Unit – IV: GENDER - BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No!-Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: “*Chupulu*”.

Domestic Violence: Speaking OutIs Home a Safe Place? -When Women Unite [Film]. RebuildingLives. Thinking about Sexual Violence Blaming the Victim-“I Fought for my Life....”

Unit – V: GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks-The Brave Heart.

Note: Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

- **Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on “Gender”.**
- **ESSENTIAL READING:** The Textbook, “*Towards a World of Equals: A Bilingual Textbook on Gender*” written by A.Suneetha, Uma Bhugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu published by Telugu Akademi, Telangana Government in 2015.

ASSESSMENT AND GRADING:

- Discussion & Classroom Participation: 20%
- Project/Assignment: 30%
- End Term Exam: 50%

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(R22MED3111) DYNAMICS OF MACHINERY

Objectives :

- Develop an ability to apply knowledge of mathematics, science, and engineering
- To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
- To develop an ability to identify, formulate, and solve engineering problems.
- To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

UNIT - I:

Angular Motion: Gyroscopes - effect of precession - motion on the stability of moving vehicles such as motorcycle - motorcar - aero planes and ships. Static and Dynamic Force Analysis of planar mechanisms.

UNIT - II:

Friction: Inclined plane - Friction of screw and nuts - Pivots and collars - uniform pressure, uniform wear - friction circle and friction axis: lubricated surfaces - boundary friction - film lubrication, Clutches, Single plate, multi plate, cone clutch, centrifugal clutches.

Brakes And Dynamometers: Simple block brake - Internal expanding brake band brake of vehicle. Dynamometers - absorption and transmission types, General description and methods of operation.

UNIT - III:

Turning Moment Diagram and Flywheels: Turning moment- Inertia torque- connecting rod angular velocity and acceleration-crank effort and torque diagrams-fluctuation of energy - flywheels and their design.

Governors: Watt, Porter and Proell governors- Spring loaded governors - Hartnell and Hartung with auxiliary springs- Sensitiveness, isochronisms and hunting- effort and power of the governors.

UNIT - IV:

Balancing: Balancing of rotating masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples. Examination of "V" and multi cylinder inline and radial engines for primary and secondary balancing- locomotive balancing - Hammer blow - Swaying couple - variation of tractive effort.

UNIT - V:

Vibrations: Free Vibration of mass attached to vertical spring - oscillation of pendulums- Transverse loads - vibrations of beams with concentrated and distributed loads. Dunkerly's method - Raleigh's method. Whirling of shafts - critical speed - torsional vibrations - one, two and three rotor systems.

TEXT BOOKS:

1. Theory of Machines / S. S. Rattan / Mc Graw Hill.
2. Theory of Mechanism and Machines / Jagdish Lal / Metropolitan Book Company.

REFERENCES BOOKS:

1. Theory of Machines / Shigley / Mc Graw Hill Publishers.
2. Theory of Machines / Thomas Bevan / Pearson.
3. Theory of Machines / R. K. Bansal / Lakshmi Publications / 5th Edition
4. Mechanism and Machine Theory / JS Rao and RV Duggipati / New Age.
5. Theory of Machines / Sadhu Singh / Pearson / 3rd Edition.
6. Mechanism and Machine Theory / Ashok G. Ambekar / PHI / Eastern Economy Edition.

Outcomes :

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

1. Use of mathematical methods to analyze the forces and motion of complex systems of linkages.
2. Design linkage, cam and gear mechanisms for a given motion or a given input/output motion or force relationship and friction circle and friction axis.
3. K4-Analyze the motion and the dynamical forces acting on mechanical systems composed of linkages, gears and cams.
4. K4-Analyze all types of brakes, Governors, balancing of masses, Hammer blow, swaying couple, traction effort.
5. Study of transverse and forced vibrations, whirling of shafts and torsional vibrations.
6. Explain the friction occurs in various types of clutches.

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(R22MED3112) DESIGN OF MACHINE ELEMENTS

Objectives : This course is intended to introduce the mechanical engineering student to the basic components of machinery, and how to select and size these components to achieve design goals in the construction of mechanical systems.

1. Understanding of the uncertainties and remedial approach pertaining to material properties and engineering analysis as a real-world engineering application.
2. Ability to select the material and configuration of different machine elements under a variety of environmental and service conditions. These includes
 - a. Joints (Cotter, Knuckle)
 - b. Shafts (Solid & Hollow)
 - c. Keys
 - d. Couplings
3. Understanding of the concepts of factor of safety
4. Ability to conduct a failure analysis for the design of machine element

NOTE : Design Data books are not permitted in the Examinations. The design must not only satisfy strength criteria but also rigidity criteria.

UNIT – I

Introduction: General considerations in the design of Engineering Materials and their properties – selection –Manufacturing consideration in design. Tolerances and fits –BIS codes of steels. Theories of failure – Factor of safety – Design for strength and rigidity – preferred numbers.

Fatigue loading: Stress concentration – Theoretical stress Concentration factor – Fatigue stress concentration factor- Notch Sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Goodman’s line – Soderberg’s line.

UNIT – II

Design of Fasteners: Riveted joints-methods of failure of riveted joints-strength equations-efficiency of riveted joints- eccentrically loaded riveted joints.

Welded joints: Design of fillet welds- axial loads-circular fillet welds-bending and torsion.

Design of bolts with pre-stresses- design of joints under eccentric loading-bolts of uniform strength.

UNIT – III

Keys, Cotters and Knuckle Joints: Design of Keys-stresses in keys-cottered joints-spigot and socket, sleeve and cotter, Gib and cotter joints-Knuckle joints.

UNIT – IV

Design of Shafts: Design of solid and hollow shafts for strength and rigidity

– Design of shafts for complex loads– Shaft sizes – BIS code- Design of shafts for gear and belt drives.

Shaft couplings : Rigid couplings – Muff, Split muff and Flange couplings. Flexible couplings – PIN-Bush coupling.

UNIT – V

Mechanical Springs: Stresses and deflections of helical springs-extension-compression springs- springs for static and fatigue loading-natural frequency of helical springs-energy storage capacity-helical torsion springs-co-axial springs.

TEXT BOOKS:

- 1) Machine design/Pandya & Shah/ Charotar Publishing House Pvt. Ltd.
- 2) Machine Design/ PV Soundararajan Murthy and N. Shanmugam/ Anuradha Publishers.

REFERENCE BOOKS:

- 1) Design of Machine Elements/V.M. Faires.
- 2) Machine design/ Schaum Series.
- 3) Mechanical Engineering Design/JE Shigley.
- 4) Machine Design/S Md. Jalaluddine/Anuradha Publishers.
- 5) Machine Design/UC Jindal/Pearson.
- 6) Design of Machine Elements (Vol.1)/T. Krishna Rao/IK International Publishing House/2nd Edition.

Outcomes :

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

1. Understand the elements of the design process.
2. Understand the yield stress and the ultimate stress of a material.
3. To calculate the endurance limit of a material with appropriate corrections.
4. To identify the stresses acting on a surface and find principal stresses.
5. To evaluate loading and stress results using principal shear stress criterion and types of welded joints, keys, cotter, knuckle joints, shafts, couplings and mechanical springs.
6. To evaluate loading and stress results using maximum distortion energy criterion and Soderberg endurance failure line.

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(R22MED3113) METROLOGY & MACHINE TOOLS

Objectives:

Where students acquire the ability to

- Formulate problems in metal cutting and evaluate the cutting parameters when vendor gives machine requirement or cutting condition requirement
- determine a complete solution to metal cutting problems using mathematical or graphical techniques, and
- determine physical and design interpretations of metal cutting parameters in design and sale of machine tools.
- Thorough evaluation of newly developed products, to ensure that components designed are within the process and measuring instrument capabilities available in the plant.
- To determine the process capabilities and ensure that these are better than the relevant component tolerances.
- To determine the measuring instrument capabilities and ensure that these are adequate for their respective measurements.
- To minimise the cost of inspection by effective and efficient use of available facilities, and to reduce the cost of rejects and rework through application of Statistical Quality Control Techniques.
- Standardisation of measuring methods. This is achieved by laying down inspection methods for any product right at the time when production technology is prepared.
- Preparation of designs for all gauges and special inspection fixtures.

UNIT - I:

Elementary treatment of metal cutting theory - Element of cutting process - Geometry of single point tool and angles chip formation and types of chips - built up edge and its effects, chip breakers. Mechanics of orthogonal cutting - Merchant's Force diagram, cutting forces - cutting speeds, feed, depth of cut, tool life, coolants, machinability - Tool materials.

UNIT - II:

Engine lathe - Principle of working, specification of lathe - types of lathe - work and tool holding devices, Taper turning, Thread turning - Lathe attachments. Turret and capstan lathe - Principle features of automatic lathes - classification: Single spindle and multi-spindle automatic lathes - tool layouts.

Shaping, slotting and planning machines - Principles of working - principal parts - specification, classification, operations performed. Kinematic scheme of shaping, slotting and planning machines, machining time calculations.

Drilling and Boring Machines - Principles of working, specifications, types, operations performed - tool holding devices - twist drill - Boring machines - Fine boring machines - Jig boring machine. Deep hole drilling machine. Kinematics scheme of the drilling and boring machines

UNIT - III:

Milling machine - Principles of working - specifications - classifications of milling machines - Principal features of horizontal, vertical and universal milling machines - machining operations Geometry of milling cutters - methods of indexing - Accessories to milling machines, kinematic scheme of milling machines

Finishing Processes: Grinding - fundamentals - theory of grinding - classification of grinding machines - cylindrical and surface grinding machine - Tool and cutter grinding machine - special types of grinding machines, Different types of abrasives - bonds specification of a grinding wheel and selection of a grinding wheel, Kinematic. Scheme of grinding machines, Honing Machines, Lapping Machines there working principles. Types of Jigs and Fixtures, 3-2-1 Principle, Types of Clamping and Work Holding devices.

UNIT - IV:

Systems of Limits and Fits: Introduction, normal size, tolerance limits, deviations, allowance, fits and their types - unilateral and bilateral tolerance system, hole and shaft basis systems – inter changeability and selective assembly. Indian standard Institution system - International Standard system for plane and screwed work.

Linear Measurement: Length standard: line and end standard, slip gauges - calibration of slip gauges, Dial indicator, micrometers.

Measurement of Angles and Tapers: Different methods - Bevel protractor - angle slip gauges - spirit levels - sine bar - Sine plate used to determine the tapers.

Limit Gauges: Taylor's principle - Design of GO and NO GO gauge, plug, ring, snap, taper, profile and position gauges.

UNIT - V:

Optical Measuring Instruments: Tool maker's microscope and its uses - collimators, optical projector - optical flats and their uses, interferometer.

Flat Surface Measurement: Measurement of flat surfaces - instruments used; straight edges, surface plates, optical flat and auto collimator.

Surface Roughness Measurement: Difference between surface roughness and surface waviness - Numerical assessment of surface finish: CLA, R.M.S Values, R_a Values, Rz value - Methods of measurement of surface finish: profilograph, Talysurf - ISI symbol for indication of surface finish.

TEXT BOOKS:

1. Principles of Machine Tools / Bhattacharya A and Sen. G. C / New Central Book Agency.
2. Workshop Technology - Vol. - II / B. S. Raghuvamsi.
3. Elements of Work Shop Technology - Vol. II / Hajra Choudary / Media Promoters.
4. Fundamentals of Metal Machining and Machine Tools / Geoffrey Boothroyd / Mc Graw Hill.
5. Manufacturing Processes / JP Kaushish / Prentice Hall / 2nd Edition.
6. Production Technology / HMT / Tata Mc Graw Hill.
7. Production Technology / R. K. Jain and S. C. Gupta / Khanna Pulishers.
8. Engineering Metrology / R. K. Jain / Khanna Publishers
9. Engineering Metrology / I C Gupta / Dhanpath Rai

REFERENCE BOOKS:

1. Machine Tools / C Elanchezhian & M. Vijayan / Anuradha Publications.
2. Dimensional Metrology / Connie Dotson / Thamson 4th Edition.
1. BIS Standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
2. Fundamentals of Dimensional Metrology / Connie Dotson / Thamson / 4th Edition.
3. Engineering Metrology / Kenneth John Hume / Mc Donald.
4. Engineering Metrology / D. M Anthony / Pergamon Press.
5. Principles of Engineering Metrology / Rega Rajendra / Jaico Publications.

Course Outcomes :

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

1. Able to understand metal cutting principles by using all types of the cutting tools with/without the coolants. All types of the chip formations.
2. Analysis various machining processes and calculate relevant quantities such as velocities, forces, powers etc.
3. Identify all types of lathe machines, their operations, drilling machines, milling machines, boring machines, shaper, slotter and planner and their cutting operations and kinematic schemes.
4. Understand the limitations of various machining processes with regard to shape formation and surface quality and the impact this has on design
5. Study of classification of grinding machine, types of abrasives and super finishing operations.
6. Able to understand linear measurement and angular measurements, limit gages, plug gages as well as optical measurements and surface roughness measurement, thread measurement, machine tool alignment tests on lathe, milling and drilling machine.

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(R22HMS1212) BUSINESS ECONOMICS & FINANCIAL ANALYSIS

Objectives:

To enable the student to understand and appreciate, with a particular insight, the importance of certain basic issues governing the business operations namely; demand and supply, production function, cost analysis, markets, forms of business organizations, capital budgeting and financial accounting and financial analysis.

Unit I

Introduction & Demand Analysis: Definition, Nature and Scope of Managerial Economics. Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

Unit II

Production & Cost Analysis: Production Function - Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

Unit III

Markets & New Economic Environment: Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. Pricing: Objectives and Policies of Pricing. Methods of Pricing. Business: Features and evaluation of different forms of Business Organisation: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, New Economic Environment: Changing Business Environment in Post-liberalization scenario.

Unit IV

Capital Budgeting: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital - Trading Forecast, Capital Budget, Cash Budget. Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of return (ARR) and Net Present Value Method (simple problems).

Unit V

Introduction to Financial Accounting & Financial Analysis: Accounting concepts and Conventions - Introduction IFRS - Double - Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Tracing Account, Profit and Loss Account and Balance Sheet with simple adjustments). Financial Analysis: Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability ratios. Du Pont Chart.

TEXT BOOKS:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2009.
2. S.A. Siddiqui & A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age international Publishers, Hyderabad 2013.
3. M. Kasi Reddy & Saraswathi, Managerial Economics and Financial Analysis, PHI New Delhi, 2012.

REFERENCES:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi, 2012.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, Pearson, 2012.
3. Lipsey & Chrystel, Economics, Oxford University Press, 2012.
4. Domnick Salvatore: Managerial Economics In a Global Economy, Thomson, 2012.
5. Narayanaswamy: Financial Accounting - A Managerial Perspective, Pearson, 2012.
6. S.N. Maheswari & S.K. Maheswari, Financial Accounting, Vikas, 2012.
7. Truet and Truet: Managerial Economics: Analysis, Problems and Cases, Wiley, 2012.
8. Dwivedi: Managerial Economics, Vikas, 2012.
9. Shailaja & Usha: MEFA, University Press, 2012.
10. Aryasri: Managerial Economics and Financial Analysis, TMH, 2012.
11. Vijay Kumar & Appa Rao, Managerial Economics & Financial Analysis, Cengage 2011.
12. J.V. Prabhakar Rao & P.V. Rao, Managerial Economics & Financial Analysis, Maruthi Publishers, 2011.

Outcomes:

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

1. Discuss the market dynamics namely, demand and supply, demand forecasting, elasticity of demand and supply, pricing methods and pricing in different market structures.
2. Justify the gain an insight into how production function is carried out to achieve least cost combination of inputs and cost analysis.
3. Analyze how capital budgeting decisions are carried out.
4. Explain the framework for both manual and computerized accounting process.
5. Analyze and interpret the financial statements through ratio analysis.
6. Explain the various methods of capital budgeting.

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(R22MED3115) STEAM POWER & JET PROPULSION

Course Objectives: At the beginning of this course the student will

- Be able to have the basic concepts of thermal sciences and their application to in formulating the thermal engineering problems.
- Have a good understanding of Gas and Steam Turbines of thermal Engineering .
- A position to fully understand the analysis to be taught at the higher levels.
- Understanding of the Boilers and its principles.

UNIT - I: Basic Concepts:

Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance - Regeneration & reheating.

Combustion: Fuels and combustion- concept of heat of reaction-adiabatic flame temperature-stoichiometry-flue gas analysis.

UNIT - II:

Boilers: Classification - Working principles with sketches including H.P. Boilers - Mountings and Accessories - Working principle.

Steam Nozzles: Function of nozzle - Applications and Types- Flow through nozzles- Thermodynamic analysis. Wilson line, Degree of Super saturation & Degree of under cooling.

UNIT - III:

Steam Turbines: Classification - Impulse turbine; Mechanical details - Velocity diagram – Effect of friction - Power developed, Axial thrust, Blade or diagram efficiency - Condition for maximum efficiency.

Reaction Turbine: Mechanical details - Principle of operation, Thermodynamic analysis of a stage, Degree of reaction - Velocity diagram - Parson's reaction turbine - Condition for maximum efficiency.

Steam Condensers: Requirements of steam condensing plant - Classification of condensers - Working principle of different types. Vacuum efficiency and condenser efficiency

UNIT - IV:

Gas Turbines: Simple gas turbine plant - Ideal cycle, essential components - Parameters of performance - Actual cycle - Regeneration, Inter cooling and Reheating - Closed and Semi - closed cycles - merits and Demerits - Brief Concepts about compressors- Combustion chambers and turbines of Gas Turbine plant.

UNIT - V:

Jet Propulsion: Principle of Operation - Classification of jet propulsive engines - Working Principles with schematic diagrams and representation on T-S diagram- Thrust, Thrust Power and Propulsion Efficiency - Turbo jet engines - Needs and Demands met by Turbo jet - Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation - Methods.

Rockets: Application - Working Principle - Classification - Propellant Type – Thrust, Propulsive Efficiency - Specific Impulse - Solid and Liquid propellant Rocket Engines

TEXT BOOKS:

1. Thermal Engineering / Rajput / Lakshmi Publications.
2. Gas Turbines / V. Ganesan / TMH.

REFERENCES BOOKS:

1. Gas Turbines and Propulsive Systems / P. Khajuria & S.P. Dubey / Dhanapatrai Pub.
2. Thermal Engineering / Ballaney / Khanna Pub.
3. Gas Turbines / Cohen, Rogers and Saravana Muttou / Addison Wesley - Longman.
4. Thermal Engineering / R.S. Khurmi & J.S. Gupta / S. Chand Pub.
5. Thermodynamics and Heat Engines / R. Yadav / Central Book Depot.
6. Thermal Engineering / Ajoy Kumar / Narosa.
7. Aircraft & Missile propulsion /MJ Zucrow/Wiley

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

1. Conduct experiments on the Boilers, Turbines.
2. Explain the principles of Jet Propulsion and rockets.
3. State the principles of steam turbines, Gas turbines, steam condensers.
4. Describe the applications and analysis of steam nozzles.
5. Discuss the types of compressors and their principles.
6. Explain the basic concepts of combustion analysis.

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(R22MED3116) FINITE ELEMENT METHODS

Objective

- 1) To provide the fundamental concepts of the theory of the finite element method:
- 2) To develop proficiency in the application of the finite element method (modeling, analysis, and interpretation of results)
- 3) To realistic engineering problems through the use of a major commercial general-purpose finite element code.
- 4) Student will be exposed to the Heat-transfer analysis, dynamic analysis by using Ansys.

UNIT - I

Introduction to Finite Element Method for solving field problems. Stress and Equilibrium. Boundary conditions. Strain – Displacement relations. Stress – strain relations for 2-D and 3-D Elastic problems.

One Dimensional Problems: Finite element modeling coordinates and shape functions. Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT – II:

Analysis of Trusses: Stiffness Matrix for Plane Truss Elements, Stress Calculations and problems.

Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node beam element and simple problems.

UNIT – III:

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Estimation of Load Vector, Stresses.

Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements.

Two dimensional four noded Isoparametric elements and problems.

UNIT – IV:

Steady State Heat Transfer Analysis: one dimensional analysis of Slab, fin and two dimensional analysis of thin plate. Analysis of a uniform shaft subjected to torsion.

UNIT – V:

Dynamic Analysis: Formulation of finite element model, element - Mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar, truss.

Finite element – formulation to 3 D problems in stress analysis, convergence requirements, Mesh generation, techniques such as semi automatic and fully Automatic use of softwares such as ANSYS, NISA, NASTRAN, etc.

TEXT BOOKS:

1. The Finite Element Methods in Engineering / SS Rao / Pergamon.
2. Finite Element Methods: Basic Concepts and applications/ Alavala/ PHI.

REFERENCE BOOKS :

1. Introduction to Finite Elements in Engineering/Chandrupatla, Ashok and Belegundu/ Prentice – Hall.
2. Finite Element Method /Zincowitz / Mc Graw Hill.
3. Introduction to Finite element analysis/ S.Md.Jalaludeen/Anuradha Publications, print-2012.
4. A First Course in the Finite Element Method/Daryl L Logan/Cengage Learning/5th Edition.
5. Finite Element Method/Krishna Murthy / TMH.
6. Finite Element Analysis /Bathe / PHI.

Outcomes :

After taking this course the students should be able to

1. To obtain an understanding of the fundamental theory of the FEA method;
2. To develop the ability to generate the governing FE equations for systems governed by partial differential equations;
3. To understand the use of the basic finite elements for structural applications using truss, beam, frame, and plane elements; and
4. To understand the application and use of the FE method for heat transfer problems.
5. To demonstrate the ability to create models for trusses, frames, plate structures, machine parts, and components using ANSYS general-purpose software;
6. To demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes;

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(R22MED3127) THERMAL ENGINEERING LABORATORY

PERFORM ANY 10 OUT OF THE 12 EXERCISES

1. I.C. Engines Valve / Port Timing Diagrams
2. I.C. Engines Performance Test for 4 Stroke SI engines
3. I.C. Engines Performance Test for 2 Stroke SI engines
4. I.C. Engines Morse, Retardation, Motoring Tests
5. I.C. Engine Heat Balance - CI/SI Engines
6. I.C. Engines Economical speed Test on a SI engine
7. I.C. Engines effect of A/F Ratio in a SI engine
8. Performance Test on Variable Compression Ratio Engine
9. IC engine Performance Test on a 4S CI Engine at constant speed
10. Volumetric efficiency of Air - Compressor Unit
11. Dis-assembly / Assembly of Engines
12. Study of Boilers
13. Wind tunnel testing.
14. Axial Flow Fan
15. Performance Test on blower

Course Outcomes

1. Conduct performance tests on 2 strokes and 4 strokes S.I and C.I engines.
2. Perform heat balance sheet, Morse test and motoring test on given engine.
3. Perform the assembly and disassembly of IC engine.
4. K5-Evaluate volumetric efficiency of air compressor practically.
5. Draw valve timing diagrams for 4 stroke engines respectively.
6. Summarize the working principle of boilers.

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(R22MED3128) METROLOGY & MACHINE TOOLS LABORATORY

Section - A:

1. Use of gear teeth vernier calipers for checking the chordal addendum and chordal height of the spur gear.
2. Machine tool alignment of test on the lathe.
3. Tool makers microscope and its application
4. Angle and taper measurements by bevel protractor and sine bars.
5. Use of spirit level and optical flats in finding the flatness of surface plate.
6. Thread measurement by 2-wire and 3-wire methods.

Section - B:

1. Introduction of general purpose machine - Lathe, Drilling machine, Milling machine, Shaper.
2. Planning machine, slotting machine, Cylindrical Grinder, surface grinder and tool and cutter grinder.
3. Step turning and taper turning on lathe machine.
4. Thread cutting and knurling on -lathe machine.
5. Drilling and Tapping
6. Shaping and Planning
7. Slotting
8. Milling
9. Cylindrical Surface Grinding
10. Grinding of Tool angles.

Course Outcomes

1. Explain the work on machines and usage of tools.
2. Produce the required job as per given dimensions in different types of machines.
3. Explain the Quick return mechanism in shaper.
4. Describe the various types of measuring devices and its measuring methods.
5. Operate the Lathe machine and conduct tool alignment test.
6. Experiment on tool makers microscope and discuss its applications.

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(R22MED3129) KINEMATICS & DYNAMICS LABORATORY

Pre-requisites:

Prerequisites for the graduate-level course are Kinematics, Dynamics, differential equations, motion simulation, displacement, velocity, acceleration, force, torque, power, Newton's motion laws, vibration, Gyroscopic Effect, Cams, Bearings.

Course Objectives:

The objective of the lab is to understand the kinematics and dynamics of mechanical elements such as linkages, gears, cams and learn to design such elements to accomplish desired motions or tasks.

Course Outcomes: Upon successful completion of this lab, students should be able to: Understand types of motion

1. Analyze forces and torques of components in linkages
2. Understand static and dynamic balance
3. Understand forward and inverse kinematics of open-loop mechanisms
4. To understand the critical speed of a given shaft for different n-conditions
5. To understand the effect of gyroscope for different motions
6. To understand time period, amplitude and frequency of un-damped free longitudinal vibration of single degree spring mass systems.

Experiments: (A Minimum of 10 experiments are to be conducted)

1. To determine the state of balance of machines for primary and secondary forces
2. To determine the frequency of torsional vibration of a given rod
3. Determine the effect of varying mass on the centre of sleeve in porter and proell governor
4. Find the motion of the follower if the given profile of the cam
5. The balance masses statically and dynamically for single rotating mass systems
6. Determine the critical speed of a given shaft for different n-conditions
7. For a simple pendulum determine time period and its natural frequency
8. For a compound pendulum determine time period and its natural frequency
9. Determine the effect of gyroscope for different motions
10. Determine time period, amplitude and frequency of un-damped free longitudinal vibration of single degree spring mass systems.
11. Determine the pressure distribution of lubricating oil at various load and speed of a Journal bearing.
12. Determine time period, amplitude and frequency of damped free longitudinal vibration of single degree spring mass systems

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(R22MAC3110) INTELLECTUAL PROPERTY RIGHTS

UNIT – I: Introduction to Intellectual property:

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II: Trade Marks:

Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III: Law of copy rights :

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV: Trade Secrets:

Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V: New development of intellectual property:

New developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT BOOKS & REFERENCES:

- Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
- Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tate McGraw Hill Publishing company ltd.,

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(R22MED3211) MACHINE DESIGN

Objectives:

Design Data Book Permitted. Design of all components should include design for strength and rigidity apart from engineering performance requirements.

1. Understanding of the uncertainties and remedial approach pertaining to material properties and engineering analysis as a real-world engineering application.
2. The Design includes
 - a. bearings
 - b. IC Engine Parts
 - c. Pulleys, Gears (Spur and Helical)
 - d. Design of Screws

UNIT – I

Bearings : Types of Journal bearings –basic modes of Lubrication – Bearing Modulus – Full and partial bearings – Clearance ratio – Heat dissipation of bearings, bearing materials – journal bearing design.

Ball and roller bearings

– Static load – dynamic load – equivalent radial load – design and selection of ball & roller bearings.

UNIT – II

Design of IC Engine Parts :

Connecting Rod : Thrust in connecting rod – stress due to whipping action on connecting rod ends – Cranks and Crank shafts, strength and proportions of over hung and center cranks – Crank pins, Crank shafts. Pistons, Forces acting on piston – Construction, Design and proportions of piston.

UNIT – III

Power Transmission Systems and Pulleys: Transmission of power by Belt and Rope ways, Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives-materials-chain drives.

UNIT – IV

Gears : Spur gears– Load concentration factor – Dynamic load factor. – analysis of spur gears –check for plastic deformation-check for dynamic and wear consideration.

Helical and bevel gear drives: Helical and bevel gears- Load concentration factor- Dynamic load factor-analysis of helical and bevel gears- check for plastic deformation-check for dynamic and wear consideration

Design of worm gears: Properties of worm gears- selection of materials-strength and wear rating of worm gears- force analysis-friction in worm gears.

UNIT – V

Design of Power Screws: Design of Screw – design of nut – compound screw – differential screw – ball screw-possible failures.

Note : Design Data Books will be provided for Exams

TEXT BOOKS:

1. Machine Design/Pandya & Shah/ Charotar Publishing House Pvt. Ltd.
2. Machine Design/ PV Soundararajan Murthy and N. Shanmugam/ Anuradha Publishers.

REFERENCE BOOKS:

1. Design of Machine Elements/V.M. Faires.
2. Machine design/ Schaum Series.
3. Mechanical Engineering Design/JE Shigley.
4. Machine Design/S Md. Jalaludine/Anuradha Publishers.
5. Machine Design/UC Jindal/Pearson.
6. Design of Machine Elements (Vol.1)/T. Krishna Rao/IK International Publishing House/2nd Edition.

Course Outcome

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

1. To understand the designs bearings, Pulleys,
2. To understand the IC Engine Parts such as connecting rod, piston.
3. To understand design of the belts and ropes their materials.
4. To Study of different types of gears.
5. To Study of the power screw and compound screw and differential screw

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(R22MED3212) HEAT TRANSFER

Course Objectives:

To equip graduates with the heat and mass transfer process that continuously takes place in buildings and human bodies and in various equipments employed in automobiles, electrical and electronic devices, chemical and process industries, power plants and refrigeration systems like condensers, evaporators, boilers, intercoolers, regenerators, etc. and to formulate simple problems and estimate rates of heat and mass transfer, temperature variation and efficiency of such equipments.

UNIT – I

Introduction, Basic Modes of heat transfer – Fundamental laws of heat transfer – Simple General discussion about applications of heat transfer.

Conduction Heat Transfer: Fourier Heat transfer equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates – simplification and forms of the field equation – steady, unsteady and periodic heat transfer – Initial and boundary conditions.

UNIT – II

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres- Composite systems– overall heat transfer coefficient – Electrical analogy – Critical radius of insulation-Variable Thermal conductivity – systems with heat sources or Heat generation-Extended surface and fins.

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance –Chart solutions of transient conduction systems.

UNIT – III

Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham Theorem and method, application for developing semi – empirical non-dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – use of empirical correlation for convective heat transfer.

Forced convection: External Flows: Flat plates and Horizontal pipes.

Free Convection: Vertical plates and pipes-concepts about Hydrodynamic and thermal boundary layer along a vertical plate.

UNIT – IV

Heat Transfer With Phase Change:

Boiling: – Pool boiling– Calculations on Nucleate boiling, Critical Heat flux and Film boiling.

Condensation: Film wise and drop wise condensation –Film Condensation on a vertical and horizontal cylinders using empirical correlations.

Radiation Heat Transfer : Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

UNIT V

Heat Exchangers: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

TEXT BOOKS :

1. Heat & Mass Transfer-D.S.Kumar/S.K.Kataria & sons.
2. Heat Transfer-P.K.Nag /Mc Graw Hill/Third Edition.

REFERENCE BOOKS:

1. Heat Transfer: A Practical Approach /Yunus Cengel, Boles / TMH.
2. Heat Transfer: A Conceptual Approach/PK Sharma, K. Rana Krishna/ New age International Publishers.
3. Heat Transfer / HOLMAN/TMH.
4. Heat and Mass Transfer/ R. Yadav /CPH.
5. Essential Heat Transfer/ Christopher A Long / Pearson Education.
6. Fundamentals of Engineering, Heat & Mass Transfer/R.C.Sachdeva/ NewAge.

Course Outcome

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

1. Formulate and predict heat conduction problems with and without heat generation in composite walls and extended surfaces subjected to convective boundaries also K4-Analyze 1D unsteady and 2D steady conduction problems.
2. Develop concept of boundary layer formation over heated surfaces during forced and free convection, formulation of momentum and energy equations of the solution by approximate method..
3. Study of heat transfer with phase change.
4. Study of the heat exchangers.
5. Explain the radiation heat transfer concepts and state the laws related to radiation.
6. Calculate Nucleate boiling, critical heat flux and film boiling also categorize types of condensation.

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(R22MED3213) CAD/CAM**Objectives :**

The course examines the area that is commonly referred to as CAD/CAM. The general objectives of the course are to enable the students to:

- Model the 3-D geometric information of machine components including assemblies, and automatically generate 2-D production drawings,
- Understand the basic analytical fundamentals that are used to create and manipulate geometric models in a computer program,
- Improve visualization ability of machine components and assemblies before their actual fabrication through modeling, animation, shading, rendering, lighting and coloring,
- Model complex shapes including freeform curves and surfaces,
- Understand the possible applications of the CAD/CAM systems in motion analysis, structure analysis, optimization, rapid prototyping, reverse engineering and virtual engineering,
- Implement CNC programs for milling and turning machining operations,
- Create a computer aided manufacturing (CAM) model and generate the machining codes automatically using the CAM system,
- Integrate the CAD system and the CAM system by using the CAD system for modeling design information and converting the CAD model into a CAM model for modeling the manufacturing information,
- Use full-scale CAD/CAM software systems designed for geometric modeling of machine components and automatic generation of manufacturing information.

Topics:

- Drawing, editing and modifying sketches
- Adding Relations and dimensions to sketches Creating reference geometries
- Creating, editing and modifying features
- Advanced part modeling (with complex geometries)
- Assembly modeling
- Introduction to geometric modeling (parametric curves, surfaces and solids)
- Coordinate transformations (translation, rotation, scaling, reflection)
- Working with drawings, views, dimensions and tolerances.
- Sheet metal design
- Mold Design
- Surface Modeling
- Simulation using Finite Element Method (stress and deformation analysis)
- Motion and mechanism simulation
- Introduction to numerical control machines and part programming
- Creation of tool path and automatic generation of part programming using CAM system
- Several advanced CAD/CAM applications will be covered as time permits

UNIT – I

Fundamentals of CAD/CAM, Automation , design process, Application of computers for design, Benefits of CAD, Computer configuration for CAD applications, Computer peripherals for CAD ,Design workstation, Graphic terminal, CAD software- definition of system software and application software ,CAD database and structure.

Geometric Modeling: 3-D wire frame modeling, wire frame entities and their definitions, Interpolation and approximation of curves, Concept of parametric and non-parametric representation of curves, Curve fitting techniques, definitions of cubic spline, Bezier, and B-spline.

UNIT-II

Surface modeling: Algebraic and geometric form, Parametric space of surface, Blending functions, parametrization of surface patch, Subdividing, Cylindrical surface, Ruled surface, Surface of revolution Spherical surface, Composite surface, Bezier surface. B-spline surface, Regenerative surface and pathological conditions.

Solid Modelling: Definition of cell composition and spatial occupancy enumeration, Sweep representation, Constructive solid geometry, Boundary representations.

UNIT – III

NC Control Production Systems : Numerical control, Elements of NC system, NC part programming : Methods of NC part programming, Manual part programming, Computer assisted part programming, Post Processor, Computerized part program, SPPL (A Simple Programming Language). CNC, DNC and Adaptive Control Systems.

UNIT – IV

Group Technology: Part families, Parts classification and coding. Production flow analysis, Machine cell design.

Computer aided process planning: Difficulties in traditional process planning, Computer aided process planning: retrieval type and generative type, Machinability data systems.

Computer aided manufacturing resource planning: Material resource planning, inputs to MRP, MRP output records, Benefits of MRP, Enterprise resource planning, Capacity requirements planning.

UNIT – V

Flexible manufacturing system: F.M.S equipment, FMS layouts, Analysis methods for FMS benefits of FMS.

Computer aided quality control: Automated inspection- Off-line, On-line, contact, Non-contact; Coordinate measuring machines, Machine vision.

Computer Integrated Manufacturing: CIM system, Benefits of CIM, Benefits of CIM

TEXT BOOKS:

1. CAD/CAM /Groover M.P./ Pearson education.
2. CAD/CAM Concepts and Applications/ Alavala/ PHI.

REFERENCE BOOKS :

1. CAD/CAM Principles and Applications/P.N.Rao/ TMH.
2. CAD / CAM Theory and Practice/ Ibrahim Zeid/TMH.
3. CAD / CAM / CIM/Radhakrishnan and Subramanian/ New Age.
4. Principles of Computer Aided Design and Manufacturing/ Farid Amirouche/ Pearson.
5. Computer Numerical Control Concepts and programming/Warren S Seames/ Thomson.

Outcomes:

After completion of this course, the students should be able to:

1. To describe the fundamental theory and concepts of the CAD/CAM.
2. Develop the concepts and underlying theory of modeling and the usage of models in different engineering applications.
3. Develop the Presentation skills
4. Compare the different types of modeling techniques and explain the central role solid models play in the successful completion of CAD/CAM-based product development.
5. Develop transformations for 2D geometric modeling.
6. Explain the basic concepts of CNC programming and machining.

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Professional Elective - I
(R22ECE3243) MICROPROCESSORS IN AUTOMATION

Objectives: To introduce the basic concepts of Digital circuits, Microprocessor system and digital Controller. Contents:

UNIT- I :

Number Systems, codes, digital electronics: Logic Gates, combinational circuits design, Flip- flops, Sequential logic circuits design: Counters, Shift registers. Introduction to 8085 Functional Block Diagram, Registers, ALU, Bus systems, Timing and control signals.

UNIT- II :

Machine cycles, instruction cycle and timing states, instruction timing diagrams, Memory interfacing.

UNIT- III :

Assembly Language Programming: Addressing modes, Instruction set, simple programs in 8085; Concept of Interrupt, Need for Interrupts, Interrupt structure, Multiple Interrupt requests and their handling, Programmable interrupt controller; Interfacing peripherals: Programmable peripheral interface (8255).

UNIT- IV:

Interfacing Analog to Digital Converter & Digital to Analog converter, Multiplexed seven segments LED display systems, Stepper Motor Control, Data Communication: Serial Data communication (8251), Programmable Timers (8253); 8086/8088 Microprocessor and its advanced features

UNIT- V :

Introduction to Digital Control: Sampling theorem, Signal conversion and Processing, Z Transform, Digital Filters, Implementation of Digital Algorithm.

Course Outcomes:

1. Students who have done this course will have a good idea of the use of microprocessors for automation.

Text Books:

1. Digital Electronics: An Introduction to Theory and Practice, William H. Gothmann, PHI Learning Private Limited
2. Digital Computer Electronics: An Introduction to Microcomputers, Albert Paul Malvino, Tata McGraw-Hill Publishing Company Ltd.
3. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, PENRAM International Publishers.
4. Digital Control Systems, Benjamin C. Kuo, Oxford University Press (2/e, Indian Edition,2007).
5. Microcomputer Experimentation with the Intel SDK-85, Lance A. Leventhal, Prentice Hall O

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Professional Elective - I (R22MED3241) MECHANICAL VIBRATIONS

Course Objectives:

1. Fully understand and appreciate the importance of vibrations in mechanical design of machine parts that operate in vibratory conditions,
2. Be able to obtain linear vibratory models of dynamic systems with changing complexities (SDOF, MDOF),
3. Be able to write the differential equation of motion of vibratory systems,
4. Be able to make free and forced (harmonic, periodic, non-periodic) vibration analysis of single and multi degree of freedom linear systems.

UNIT- I: Single Degree of Freedom Systems : Undamped and damped free vibrations; forced vibrations coulomb damping; Response to excitation; rotating unbalance and support excitation; vibration isolation and transmissibility- Response to Non Periodic Excitations: unit impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.

UNIT- II: Two Degree Freedom Systems: Principal modes- undamped and damped free and forced vibrations; undamped vibration absorbers;

UNIT-III: Multi Degree Freedom Systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi- rotor systems and geared systems; Discrete- Time systems.

Vibration measuring instruments: Vibrometers, velocity meters & accelerometers

UNIT- IV: Frequency Domain Vibration Analysis: Over view, machine-train monitoring parameters- Data base development-vibration data acquisition-trending analysis-failure- node analysis-signature analysis-root cause analysis.

UNIT V: Numerical Methods: Raleigh's stodola's, Matrix iteration, Rayleigh- Ritz Method and Holzer's methods.

TEXT BOOKS:

1. Mechanical Vibrations/Groover/Nem Chand and Bros.
2. Elements of Vibration Analysis / Meirovitch/ TMH, 2001.

REFERENCE BOOKS:

1. Mechanical Vibrations/VP Singh/Danapathi Rai & Sons.
2. Mechanical Vibrations/ SS Rao/ Pearson, 2009/4th Edition.
3. Mechanical Vibrations/Debabrata Nag/Wiley.
4. Vibration problems in Engineering / S.P. Timoshenko.
5. Mechanical Vibrations and sound engineering/ A.G.Ambekar/ PHI.
6. Theory and Practice of Mechanical Vibrations/JS Rao & K. Gupta/ New Age Intl. Publishers/Revised 2nd Edition

Course Outcomes:

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

1. Understand the causes and effects of vibration in mechanical systems and Single ,Two and Multi degrees of freedom
2. Develop schematic models for physical systems and formulate governing equations of motion.
3. Understand the role of damping, stiffness and inertia in mechanical systems
4. Analyze rotating and reciprocating systems and compute critical speeds.
5. Analyze and design machine supporting structures, Frequency domain vibration analysis
6. To understand the basic numerical methods

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Professional Elective - I
(R22MED3242) POWER PLANT ENGINEERING

Course Objectives:

1. Basic knowledge of Different types of Power Plants, site selection criteria of each one of them.
2. Understanding of Thermal Power Plant Operation, turbine governing, different types of high pressure boilers including supercritical and supercharged boilers, Fluidized bed combustion systems.
3. Design of chimney in thermal power plants, knowledge of cooling tower operation, numerical on surface condenser design.
4. Basic knowledge of Different types of Nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.
5. Understanding of Power Plant Economics, Energy Storage including compressed air energy and pumped hydro etc.
6. Discussing environmental and safety aspects of power plant operation.

UNIT – I

Introduction to the Sources of Energy – Resources and Development of Power in India. **Steam Power Plant** : Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

UNIT – II

Internal Combustion Engine Plant:

DIESEL POWER PLANT: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging. **Gas Turbine Plant:** Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison. **Direct Energy Conversion:** Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

UNIT – III

Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways. **Hydro Projects And Plant:** Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants. **Power From Non-Conventional Sources:** Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

UNIT – IV

Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation. **Types of Reactors:** Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT – V

Power Plant Economics And Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

TEXT BOOKS :

- 1) Power Plant Engineering/ P.C.Sharma / S.K.Kataria Pub.
- 2) A Course in Power Plant Engineering: / Arora and S. Domkundwar.

REFERENCES :

1. A Text Book of Power Plant Engineering / Rajput / Laxmi Publications.
2. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
3. An Introduction to Power Plant Technology / G.D. Rai/Khanna Publishers.
4. Power plant Engg / Elanchezhian/ I.K. International Pub.
5. Power plant Engineering/ Ramalingam/ Sciotech Publishers.

Course Outcomes:

After taking this course the students should be able to

1. Basic knowledge of Different types of Power Plants, site selection criteria of each one of them.
2. Understanding of Thermal Power Plant Operation, turbine governing, different types of high pressure boilers including supercritical and supercharged boilers, Fluidized bed combustion systems.
3. Design of chimney in thermal power plants, knowledge of cooling tower operation, numerical on surface condenser design.
4. Basic knowledge of Different types of Nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.
5. Understanding of Power Plant Economics, Energy Storage including compressed air energy and pumped hydro etc.
6. Discussing environmental and safety aspects of power plant operation.

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Professional Elective - I
(R22MED3244) UNCONVENTIONAL MACHINING PROCESSES

Objectives:

1. To understand the need and importance of non-traditional machining methods.
2. To know the basic principle, equipment, process variables and mechanics of metal removal in abrasive jet machining and water jet machining.
3. To study the fundamentals of tool design, surface finishing and metal removal rate of electro chemical grinding , electro chemical machining and electro chemical honing.
4. To understand principles of operation, types of electrodes and process parameters and machine tool selection in EDM and Electric discharge grinding and wire cut process.
5. To know the basics of Electron Beam Machining and comparison of thermal and non thermal processes.
6. To study the various process parameters and applications of Plasma in manufacturing industries.

UNIT I Introduction to NTMM, history of Non Traditional Machining methods, classification of NTM methods, need of NTMM development, process selection of NTMM, physical parameters of Non Traditional processes, shapes to be cut by NTMM, process capability, process economy, the present scenario of NTMM, difference between conventional and non non-traditional machining methods, applications of non traditional machining methods, advantages and disadvantages of NTMM,

UNIT II Introduction to Ultra Sonic Machining: History of USM, principle and working of USM, mechanism of USM, mechanical system and various components of USM, basic components for cutting action of USM, process parameters and their effects on MRR, advantages, disadvantages and applications of USM. Material removal models in USM, future scope and recent developments of Ultrasonic machining. Introduction and history of RUSM, problems on USM. Abrasive Jet Machining(AJM) Introduction to AJM, schematic diagram, working process, process capability, process parameters of AJM, effect of process parameters on MRR, advantages and disadvantages of AJM, material removal models in AJM, problems in AJM.

Water Jet Machining(WJT): Introduction to WJT, principle, history and schematic diagram of WJT, Construction of WJM, classification of water jets, abrasive water jet system process parameters, advantages, disadvantages and applications of WJM, machining of different work piece materials by WJM, recent developments in Abrasive water jets.

UNIT III Chemical Machining (CHM): Introduction to chemical machining, history, maskant types, advantages, limitations, applications of CHM. Photo chemical machining (PCHM), process, applications, economy, advantages and disadvantages of PCHM. Electrical Chemical Machining(ECM) Introduction to ECM, history of ECM , principle and equipment of ECM Process, working of ECM.

Elements of ECM, process parameters ECM, design techniques of ECM Tooling, operation, advantages, disadvantages, applications of ECM, Similarities between EDM and ECM.

Electrochemical grinding ECG applications, advantages, disadvantages of ECG. Electro Chemical Deburring, Electro chemical turning, Electro chemical sawing, ECM tooling and its characteristics, future scope of ECM

UNIT IV introduction to electrical discharge machine (EDM):History, process, equipment, electrode material, dielectric fluid reservoir, power supply of EDM, Analysis of RC Relaxation Generator of EDM, Power generators of EDM, Process parameters and their effect on MRR of EDM, characteristics of EDM, methods of improving MRR by electrode design in EDM, capabilities, advantages and disadvantages, Applications of EDM, different types of EDM.

Wire EDM : Development of wire EDM, influence of process parameters of WEDM process, process

parameters, advantages and disadvantages of WEDM, Scope of EDM, advanced EDMs, Powder mixed electrical discharge machining (PMEDM), History of PMEDM, Applications of PMEDM, Future scope of PMEDM, Cryogenic electrical discharge machining, Experimental methodology, cryogenic treatment, future scope of cryogenic EDM.

UNIT V Laser Beam Machining: Introduction of Laser beam machining(LBM), History, Principle, Lasing action, Laser Medium, Population Inversion of Laser, Process of LBM, Mechanism of material removal in Laser cutting, Classification of Lasers Based on material, Classification of Laser beam based on pulse, properties of lasers, LASER process characteristics, Methods of cutting of materials by lasers, Types of laser cutting machines, requirement of laser, various process parameters of LBM, LBM Applications, Advanced LBM methods, History of pulsed LBM, Laser Ablation, LBM Applications, Advantages and disadvantages of LBM.

Electron Beam Machining (EBM): Introduction to Electron beam machining, working process of EBM, history, parts, process characteristics, specifications, process parameters, process capability, Advantages ,disadvantages and applications of EBM.

Plasma Arc Machining (PAM): Introduction to PAM, History, gases used in PAM, system components of PAM, types of arcs of PAM, key process variables of PAM, development of PAM.

Advanced Unconventional machining methods: Introduction to Advanced Unconventional machining methods, Magnetic Abrasive finishing (MAF), processing principle, magnetic field sources, motion facilitating equipment, working principle of magnetic abrasive finishing, the effect of process parameters of MAF.

Shaped Tube Electrolytic Machining (STEM), Electro Stream Drilling (ESD), Types of ESD, performance of ESD.

Abrasive Flow Machining, Abrasive flow machining parameters, AFM applications, Benefits and Future Scope.

TEXT BOOK:

1. Advanced machining processes - VK Jain, Allied publishers.

REFERENCES :

1. Modern Machining Process - Pandey P.C. and Shah H.S., TMH.
2. New Technology - Bhattacharya A, The Institution of Engineers, India 1984.
3. Unconventional Machining Processes - C. Elanchezian,, B. Vijaya Ramnath and M Vijayan, Anuradha Publications, 2005.
4. Unconventional Manufacturing Processes – M.K. Singh, New Age International Publishers.
5. Dr. P. Mallesham, “A Book on Recent Trends in Unconventional Machining Methods”, Research India Publication, 2018

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

1. Understand the basic techniques of unconventional machining processes
2. Understand the economical aspects of unconventional machining
3. Understand the need and type of material to machined by unconventional methods.
4. Ability to extend the knowledge of unconventional machining methods to various industries suchas aerospace, nuclear and defense industries.
5. To understand the Various unconventional machining methods are categorized based on their energies such asMechanical, Electro Chemical, Electro Thermal and chemical energies.
6. To understand the processes for thermal EDM, LBM, PAM, WEDM and EBM.

LIST OF OPEN ELECTIVES**Open Elective – I**

S. No.	Course Code	Course Title	L	T	P	Credits
1	R22CIV3235	Disaster Management & Mitigation	3	0	0	3
2	R22CSE3235	Database Concepts				
3	R22ECE3235	Consumer Electronics				
4	R22EEE3235	Electrical Estimation & Costing				
5	R22INF3235	Information Technology Essentials				
6	R22MED3235	Introduction to Robotics				
7	R22HMS3233	Fundamentals of Entrepreneurship				
8	R22HMS3235	Day to Day Biology				

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L	T	P	C
3	0	0	3

(R22CIV3235) Disaster Management & Mitigation

The objective of this course is to provide an understanding of basic concepts of various disasters and its management. In addition, the course is expected to develop scientific temperament and mitigation techniques to manage disaster.

1. To understand basic concepts of disaster and hazards of India.
2. To study the various natural disasters.
3. To study the various manmade disasters.
4. To understand the disaster management principles.
5. To study the modern techniques used in disaster mitigation and management.

UNIT I - Introduction To Disaster - Meaning, Nature, Importance of Hazard, Risk, Vulnerability and Disaster Dimensions & Scope of Disaster Management - India's Key Hazards – Vulnerabilities - National disaster management framework - Disaster Management Cycle.

UNIT II - Natural Disaster - Natural Disasters- Meaning and nature of natural disaster; their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

UNIT III - Anthropogenic Disaster - Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation and industrial waste water pollution.

UNIT IV - Approaches in Disaster Management - Pre- disaster stage (preparedness) - Preparing hazard zonation maps, Predictability/ forecasting & warning - Preparing disaster preparedness plan Land use zoning - Preparedness through Information, education. Emergency Stage - Rescue training for search & operation - Immediate relief - Assessment surveys. Post Disaster stage – Rehabilitation - Social Aspect - Economic Aspect and Environmental Aspect.

UNIT V - Disaster Mitigation - Meteorological observatory - Seismological observatory - Hydrology Laboratory and Industrial Safety inspectorate. Technology in Disaster Management Emergency Management Systems (EMS) in the Disaster Management Cycle Remote Sensing and Geographic Information Systems(GIS) in Disaster Management.

TEXT BOOK

1. Sharma.S.R, "Disaster management", A P H Publishers, 2011.

REFERENCES

6. VenuGopalRao.K, "Geoinformatics for Disaster Management", Manglam Publishers and Distributors, 2010.
7. Singh.R.B, "Natural Hazards and Disaster Management: Vulnerability and Mitigation", Rawat Publications, 2006.
8. Gupta.H.K, "Disaster Management", University Press, India, 2003.
9. Gupta.M.C, "Manuals on Natural Disaster management in India", National Centre for Disaster Management,IIPA, New Delhi, 2001.

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L	T	P	C
3	0	0	3

(R22CSE3235) Database Concepts

To study the concepts of Relational Database design and query languages

1. To provide a general introduction to relational model
2. To learn about ER diagrams
3. To learn about Query processing and Transaction Processing

UNIT I: Introduction to Database Management - Introduction to Database Management systems – History - Characteristics – Users- three-level architecture- Entity-- relationship data model.

UNIT II: The Relational Data Model and Relational Algebra - Data structures – Mapping E-R Model to Relational model – data manipulation – integrity – advantages – rules for fully relational systems – relational algebra – relational algebra queries.

UNIT III: Structured Query Language and Normalization - SQL – Data definition – manipulation – views SQL in procedural programming – data integrity and constraints – triggers – data control – database security. Normalization – Undesirable properties – single-valued normalization – desirable properties of decompositions – multivalued dependencies

UNIT IV: Storage Indexing and Transactions Management - Different types of memories – secondary storage – buffer management – file structures – heap files – sorted files – index and types – indexed sequential file – B-tree – B+ tree. Transaction management – concepts – examples – schedules – serializability – concurrency control – deadlocks – lock and multiple granularity – nonlocking techniques.

UNIT V: Database Backup, Recovery and Security - Database system failure – backup – recovery and concept of log – log-based recovery techniques – types of recovery – log-based immediate update recovery technique. Database Security – violations – identifications and authentication – authorization / access control – security of statistical databases – audit policy – internet applications and encryption.

TEXT BOOK

1. Gupta.G.K, “Database Management Systems”, Tata McGraw Hill, 2011.

REFERENCES

1. Silberschatz, Korth.H and Sudarshan.S, “Database System Concepts”, 6th Edition, McGraw-HillInternational, 2011.
2. Hector Garcia-Molina, Jeffrey D.Ullman, Jennifer Widom, “Database System The Complete Book, 1st Edition, Pearson 2002.
3. RamezElmasri and ShamkantB.Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson, 2008.

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OPEN ELECTIVE- I

L	T	P	C
3	0	0	3

(R22ECE3235) Consumer Electronics

Course Objectives:

- Students are able to understand consumer electronics fundamentals, microprocessors and microcontrollers, energy management and intelligent building perspective. Audio systems, Display systems, video systems and recording systems
- Student is able to demonstrate smart Home, Home Virtual Assistants, Home security systems and types of sensors RFID Home , kitchen electronics and smart alarms, smart toilet, smart floor and smart locks
- Students are able to discuss cordless telephones, Fax machines PDA's TABLETs Smart phones and Smart watches. Video conferencing systems, Internet enabled systems, Wi-Fi, Li-Fi, GPS and Tracking systems

UNIT I: Consumer Electronics Fundamentals - History of Electronic Devices- Vacuum Tubes, Transistors, Integrated Circuits- Moore Law, Semiconductor Devices, Diodes, Rectifiers, Transistors, Logic Gates, Combinational Circuits, ADC, DAC and Microprocessors, Microprocessor Vs Microcontrollers, Microcontrollers in consumer electronics, Energy management, Intelligent Building Perspective.

UNIT II: Entertainment Electronics - Audio systems: Construction and working principle of : Microphone, Loud speaker, AM and FM receiver, stereo, 2.1 home theatre, 5.1 home theatre . Display systems: CRT, LCD, LED and Graphics displays Video Players : DVD and Blue RAY. Recording Systems: Digital Cameras and Camcorders.

UNIT III: Smart Home - Technology involved in Smart home, Home Virtual Assistants- Alexa and Google Home. Home Security Systems - Intruder Detection, Automated blinds, Motion Sensors, Thermal Sensors and Image Sensors, PIR, IR and Water Level Sensors.

UNIT IV: Home Appliances - Home Enablement Systems: RFID Home, Lighting control, Automatic Cleaning Robots, Washing Machines, Kitchen Electronics- Microwave, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart toilet, Smart floor, Smart locks.

UNIT V: Communication Systems - Cordless Telephones, Fax Machines, PDAs- Tablets, Smart Phones and Smart Watches. Introduction to Smart OS- Android and iOS. Video Conferencing Systems- Web/IP Camera, Video security, Internet Enabled Systems, Wi-Fi, IoT, Li-Fi, GPS and Tracking Systems.

TEXT BOOKS:

1. Thomas L Floyd "Electronic Devices" 10th Edition Pearson Education Asia 2018.
2. Philp Hoff "Consumer Electronics for Engineers" - Cambridge University Press.1998.
3. Jordan Frith, " Smartphones as Locative Media ", Wiley. 2014.
4. Dennis C Brewer, " Home Automation", Que Publishing 2013.
5. Thomas M. Coughlin, "Digital Storage in Consumer Electronics", Elsevier and Newness 2012.

Course Outcomes:

- C325.1. summarize the consumer electronics fundamentals and explain about microprocessors and microcontrollers, energy management and intelligent building perspective (K2-Understand)
- C325.2. Demonstrate Audio systems, Display systems, video systems and recording systems (K3-Apply)
- C325.3. Describe the smart Home, Home Virtual Assistants, Home security systems and Different types of sensors (K2-Understand)
- C325.4. Outline the home enablement systems like RFID Home, kitchen electronics and smart alarms, smart toilet, smart floor and smart locks. (K4-Analyse)
- C325.5. Discuss cordless telephones, Fax machines PDA's TABLETs Smart phones and Smart watches.
- C325.6. Compare and explain Android and iOS and demonstrate Video conferencing systems, Internet enabled systems, Wi-Fi, Li-Fi, GPS and Tracking systems. (K5-Evaluate)

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OPEN ELECTIVE- I

L	T	P	C
3	0	0	3

(R22EEE3235) Electrical Estimation & Costing

Unit I: Electrical Symbols and Diagrams: (i) Need of symbols; List of symbols for electrical equipment and accessories used in electrical works. Light, fan and power circuits, alarm and indicating circuit, contactor control circuits as per I.S.S. (ii) Type of diagrams - Wiring diagrams (multiple and single line representation) and schematic diagrams as per I.S.S. (* One Drawing Sheet for at least - 50 symbols).

Wiring materials and accessories: (1) Brief description, general specifications (as per I.S.S.) and approximate cost of different types of wires, cables, switches, distribution board, switch board, boxes, batten and its accessories, conduit and its accessories, lamp holders, socket outlets, plug ceiling roses. Fuse and energy meter used in domestic and power wiring installations.

Unit II: Light and Fan Circuits: Schematic and wiring diagrams (multiline and single line both) using junction boxes and looping systems for the following types of circuits:- (i) Light and fan controlled by necessary switches and regulators. (ii) Stair case wiring (iii) Corridor lighting (iv) One lamp controlled by three or more switches.

Unit III: Principles of Estimating and Costing: Purpose of estimating and costing, essentials of estimating and costing-market survey, price list and net prices, preparation of list of materials, calculation of material and labor cost, contingencies, overhead charges, profit and total cost. Estimation of Domestic Internal Wiring Circuits: (i) Description of various wiring systems and methods. (ii) Need of earthing and point to be earthed in internal wiring system as per IE rules. (iii) I.S. specifications, calculation of No. of points (light, fan, socket outlet), calculation of total load including domestic power, determination of no. of circuits, size of wires and cables, switches and main switch, distribution board and switch board, batten conduit and other wiring accessories.

Unit IV: Estimation of Power Wiring: I.S. specifications and I.E. rules, calculation of current for single and three phase motors. Determination of sizes of cables, conductors distribution board, main switches and starters for power circuits. Cost of equipment and accessories and schedule of materials. Estimation and cost of material and work for motors up to 20 H.P., pump sets and small workshops.

Unit V: Estimation of Overhead and Underground Distribution Lines: Main components of overhead lines-line supports, cross-arm, clamps, conductors and stay sets, lightning arrestors, danger plates, ant climbing devices, bird guards, jumpers etc., concreting of poles, earthing of transmission line, formation of lines, specification of materials for O.H. lines, I.S. specification and I.E. rules. Cost of material and work for overhead and underground lines upto 11 KV only.

Estimation of Small Sub-Station: Main equipment and auxiliaries installed on the substation. Estimation of materials required for a small distribution substation (indoor and outdoor type platform and pole mounted). Costing of material and work of above substations.

Text Books:

1. S.K Bhattacharya, "Electrical Engineering Drawing & Design Estimating".Wiley Eastern Ltd. New Delhi.
2. Surjeet Singh, "Electrical Eesign& Drawing" S.K.Kataria& Sons New Delhi.

Reference Books:

1. O. P. Soni," Electrical Engg. Design & Drawing" SatyaPrakashan Delhi.

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OPEN ELECTIVE- I

L	T	P	C
3	0	0	3

(R22INF3235) Information Technology Essentials

COURSE OBJECTIVES:

- To introduce the principles required for building web applications.
- To provide working knowledge of the technologies needed for web application development
- To know about scripting languages.
- To understand principles of database access and storage.
- To understand various applications related to Information Technology.

COURSE OUTCOMES: Student will be able to

- Design and deploy web-sites
- Design and deploy simple web-applications
- Create simple database applications
- Develop an information system
- Describe the basics of networking

UNIT I: Web Essentials - Creating a Website - Working principle of a Website - Browser fundamentals - Authoring tools - Types of servers: Application Server - Web Server - Database Server – HTML basics – HTML tags and their use

UNIT II: Scripting Essentials - Need for Scripting languages - Types of scripting languages - Client side scripting - Server side scripting - PHP - Working principle of PHP - PHP Variables - Constants - Operators – Flow Control and Looping - Arrays - Strings - Functions - File Handling - PHP and HTML - Cookies – Sessions - Authentication – Introduction to JavaScript

UNIT III: Database Essentials - Database management - Database terms - MySQL - commands – Data types – Indexes – Functions – Accessing MySQL using PHP.

UNIT IV: Networking Essentials - Fundamental computer network concepts - Types of computer networks - Network layers - TCP/IP model - Wireless Local Area Network - Ethernet - WiFi - Network Routing - Switching - Network components

UNIT V: Application Essentials - Creation of simple interactive applications - Simple database applications - Multimedia applications - Design and development of information systems – Personal Information System – Information retrieval system – Social networking applications

TEXT BOOKS:

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'REILLY, 2014.
2. James F. Kurose, "Computer Networking: A Top-Down Approach", Sixth Edition, Pearson, 2012.

REFERENCES:

1. GottapuSasibhushanaRao, "Mobile Cellular Communication", Pearson, 2012.
2. R. Kelly Rainer , Casey G. Cegielski , Brad Prince, Introduction to Information Systems, Fifth Edition, Wiley Publication, 2014.
3. it-ebooks.org

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OPEN ELECTIVE- I

L	T	P	C
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(R22MED3235) Introduction to Robotics

COURSE OBJECTIVE: To impart knowledge about the basics of robot components and applications.

COURSE OUTCOMES:

1. Basics of Robot anatomy
2. Working of end effectors and drive systems
3. Kinematics and transformation analysis of robot
4. Various types of robot sensors
5. Robot cell design and applications of robot

UNIT I: Robot Basics - Robot-Basic concepts, Need, Law, History, Anatomy, specification. Robot configurations-Cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision and accuracy of robot-simple problems.

UNIT II: Robot Elements - End effectors-Classification, Types of Mechanical actuation, Gripper force analysis, Gripper design, Robot drive system-Types, Position and velocity feedback devices-Robot joints and links-Types, Motion interpolation.

UNIT III: Robot Kinematics - Robot kinematics – Direct and inverse kinematics – 2 and 3 DOF of kinematics analysis-Robot trajectories – Control of robot manipulators – Point to point, Contouring motion- 2D and 3D Transformation-Scaling, Rotation, Translation, Homogeneous coordinates, multiple transformation-Simple problems.

UNIT IV: Robot Sensors - Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors

UNIT V: Robot Cell Design And Applications - Robot work cell design and control – Safety measures in Robot – Robot cell layouts – Multiple robots and machine interference – Robot cycle time analysis – Industrial applications of robots, Nanorobots, Robot programming-Basic program.

TEXT BOOKS:

1. Deb.S.R, “Robotics Technology and Flexible Automation”, Tata McGraw – Hill Publishing Company Limited, 2010.
2. Mikell. P. Groover, ‘Industrial Robotics Technology’, Programming and Applications, McGraw Hill Co, 2008.

REFERENCES:

1. Klafter.R.D, Chmielewski.T.A, and Noggin’s., “Robot Engineering : An Integrated Approach”, Prentice Hall of India Pvt. Ltd.,1994.
2. Fu.K.S, Gonzalez.R.C&Lee.C.S.G, “Robotics control, sensing, vision and intelligence”, McGraw Hill Book co, 1987
3. Craig.J.J, “Introduction to Robotics mechanics and control”, AddisonWesley, 1999.
4. Ray Asfahl.C, “Robots and Manufacturing Automation”, John Wiley & Sons Inc., 1985.
5. Kozyrey, Yu. “Industrial Robotics”, MIR Publishers Moscow, 1985.

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OPEN ELECTIVE- I

L	T	P	C
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(R22HMS3233) Fundamentals of Entrepreneurship

COURSE OBJECTIVES: To create awareness on entrepreneurship among engineering students and stimulating self-motivation to start up enterprise

COURSE OUTCOMES:

1. To provide awareness about entrepreneurship
2. To develop idea generation, creative and innovative skills
3. To self-motivate the students by making aware of different opportunities and successful growth stories
4. To learn how to start an enterprise and design business plans those are suitable for funding by considering all dimensions of business.
5. To understand entrepreneurial process by way of studying different case studies and find exceptions to the process model of entrepreneurship.
6. To run a small enterprise with small capital for a short period and experience the science and art of doing business.

UNIT I: Introduction to Entrepreneurship - Understanding the Meaning of Entrepreneur; Characteristics and Qualities of an Entrepreneur; Entrepreneurs Vs Intrapreneurs and Managers; Classification of Entrepreneurs; Factors Influencing Entrepreneurship; Entrepreneurial Environment; Entrepreneurial Growth; Problems and Challenges of Entrepreneurs; Entrepreneurial Scenario in India.

UNIT II: Micro, Small and Medium Enterprises (MSMEs) - MSMEs – Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes, Forms of Business; Women Entrepreneurship; Rural Entrepreneurship; Family Business and First Generation Entrepreneurs.

UNIT III: Idea Generation and Feasibility Analysis - Idea Generation; Creativity and Innovation; Identification of Business Opportunities; Market Entry Strategies; Marketing Feasibility; Financial Feasibilities; Political Feasibilities; Economic Feasibility; Social and Legal Feasibilities; Technical Feasibilities; Managerial Feasibility, Location and Other Utilities Feasibilities.

UNIT IV: Business Model and Plan in Respective Industry - Business model – Meaning, designing, analyzing and improvising; Business Plan – Meaning, Scope and Need; Financial, Marketing, Human Resource and Production/Service Plan; Business plan Formats; Project report preparation and presentation; Why some Business Plan fails?

UNIT V: Financing and How to Start up Business? - Financial opportunity identification; Banking sources; Non-banking Institutions and Agencies; Venture Capital – Meaning and Role in Entrepreneurship; Government Schemes for funding business; Pre launch, Launch and Post launch requirements; Procedure for getting License and Registration; Challenges and Difficulties in Starting an Enterprise.

TEXT BOOKS :

1. Jayshree Suresh, “Entrepreneurial Development”, Margham Publishers, Chennai, 2011.
2. Poornima M Charantimath, “Entrepreneurship development small business enterprises”, Pearson, 2013.

REFERENCES:

1. Raj Shankar, “Entrepreneurship: Theory And Practice”, Vijay Nicole imprints ltd in collaboration with Tata Mc-graw Hill Publishing Co.ltd.-new Delhi, 2012
2. Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, “Entrepreneurship”, 8th Edition, Tata Mc-graw Hill Publishing Co.ltd.-new Delhi, 2012
3. Martin Roger, “The Design of Business”, Harvard Business Publishing, 2009
4. Roy Rajiv, “Entrepreneurship”, Oxford University Press, 2011
5. Drucker.F, Peter, “Innovation and Entrepreneurship”, Harper business, 2006.

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B.Tech. - III Year – II Semester

OPEN ELECTIVE - I

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(R22HMS3235) Day to Day Biology

COURSE OBJECTIVE: The purpose of this study is to know and understand the involvement of biology in day-to-day life. This would give insight into his or her own biological system, the diseases and disorders, antibiotics, and importance of environment in human life. This also provides application of biology in day to day life.

COURSE OBJECTIVES:

1. The student can understand the biology of human system and health.
2. This provides student with a scope for selection of healthy food and sustain environment.

UNIT I: Biology of Human Diseases and Disorders - Diabetes mellitus, communicable diseases, genetic disorders, vector borne diseases, antibiotics - mode of action.

UNIT II: Biology for Human - Blood pressure, immune system and immunity, cardiac infarction, in vitro fertilization, cord blood bank, stem cells.

UNIT III: Biology of Cosmetics and Detergents - Biology of complexion and texture, bioactive natural products in industrial use, bio surfactants, antioxidants.

UNIT IV: Biology and Nutrition - Dietary index, carbohydrates, proteins and fats, HDL and LDL, dairy products and application, herbal plants and home remedies.

UNIT V: Biology and Environment - Water pollution, air pollution, bioremediation, species biodiversity, global warming and greenhouse effect.

TEXT BOOKS:

1. Gareth J. Price, Biology: An Illustrated Guide to Science, Diagram Group, Infobase Publishing, 2006.
2. Pam Dodman, Real-Life Science Biology, Walch Publishing, 2008.

REFERENCES:

1. Biology: The Science of Life, Stephen Nowicki, <http://www.thegreatcourses.com/tgc/courses>.
2. Neil Schlager, Science of everyday things: Real-Life Biology, Gale Publishing 2002.

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B.Tech. - III Year – II Semester

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(R22MED3226) HEAT TRANSFER LAB

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere (Insulating Powder)
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction (Unsteady State Heat Conduction)
7. Heat transfer in forced convection apparatus.
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Film and Drop wise condensation apparatus

Course Outcomes

1. Perform experiment and calculate the thermal conductivity through metal, insulating powder and lagged pipe.
2. Determine the heat transfer coefficient and heat transfer rate in natural convection, forced convection in parallel and counter flow heat exchanger.
3. Determine the emissivity, Stefan Boltzmann constant to estimate heat transfer through radiation by conducting experiment.
4. Solve the heat transfer in conduction process and to determine critical temperature of heat element.
5. Learn the heat pipe principle and two phase flow principle.
6. Study of heat transfer in pin-fin apparatus.

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B.Tech. - III Year – II Semester

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(R22MED3228) COMPUTER AIDED ENGINEERING LABORATORY

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances.
2. Part Modeling: Generation of various 3D Models through Protrusion, revolve, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling and Assembly Modeling. Study of various standard Translators. Design of simple components.
3. Determination of deflection and stresses in 2D and 3D trusses and beams.
4. Determination of deflections, principal and Von-mises stresses in plane stress, plane strain and Axi-symmetric components.
5. Determination of stresses in 3D and shell structures (at least one example in each case)
6. Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
7. Study state heat transfer analysis of plane and axi-symmetric components.
8. Development of process sheets for various components based on Tooling and Machines.
9. Development of manufacturing defects and tool management systems.
10. Study of various post processors used in NC Machines.
11. Development of NC code for free form and sculptured surfaces using CAM software.
12. Machining of simple components on NC lathe and Mill by transferring NC Code / from CAM software.
13. Quality Control and inspection.

Course Outcomes

- 1 To Create 2-D & 3-D drawings using AutoCAD.
- 2 Draw assembly drawings using PRO-E.
- 3 Determine deflections and stresses in various beams and structures by using ANSYS.
- 4 Predict natural frequencies of 2D beams and perform study state heat transfer analysis of plane and axi-symmetric components.
- 5 Develop NC code for Turning operations using CAM software and machine simple components on NC lathe by transferring NC code from CAM software.
- 6 Develop NC code for free form using CAM software and machine simple components on NC Mill by transferring NC code from CAM software.

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(R22HAS3228) ADVANCED ENGLISH COMMUNICATION SKILLS LABORATORY**Introduction**

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

Syllabus:

The following course content to conduct the activities is prescribed for the Advanced Communication Skills (ACS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ e-mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

Minimum Requirement:

The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 35 students in the lab:

- **Spacious room with appropriate acoustics.**
- **Round Tables with movable chairs**
- **Audio-visual aids**
- **LCD Projector**
- **Public Address system**
- **P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ**
- **T. V, a digital stereo & Camcorder**
- **Headphones of High quality**

Prescribed Lab Manual: A book titled *A Course Book of Advanced Communication Skills (ACS) Lab* published by Universities Press, Hyderabad.

Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

- **Oxford Advanced Learner’s Compass, 7th Edition**
- **DELTA’s key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider, by Dreamtech**
- **TOEFL & GRE(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)**
- **The following software from ‘train2success.com’**
 - **Preparing for being Interviewed**
 - **Positive Thinking**
 - **Interviewing Skills**
 - **Telephone Skills**
 - **Time Management**

Books Recommended:

- 1) Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
- 2) Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
- 3) Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
- 4) Business and Professional Communication: Keys for Workplace Excellence. Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications. 2011.
- 5) The Basics of Communication: A Relational Perspective. Steve Duck & David T. McMahan. Sage South Asia Edition. Sage Publications. 2012.
- 6) English Vocabulary in Use series, Cambridge University Press 2008.
- 7) Management Shapers Series by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.
- 8) Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
- 9) Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
- 10) Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.
- 11) Job Hunting by Colm Downes, Cambridge University Press 2008.
- 12) Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.
- 13) English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hil 2009.
- 14) Books on TOEFL/GRE/GMAT/CAT/ IELTS by Barron’s/DELTA/ Cambridge University Press.
- 15) International English for Call Centres by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

DISTRIBUTION AND WEIGHTAGE OF MARKS:

Advanced Communication Skills Lab Practicals:

1. The practical examinations for the ACS Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the English Language lab sessions, there shall be continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned, by inviting the External Examiner from outside. In case of the non-availability of the External Examiner, other teacher of the same department can act as the External Examiner.

Mini Project: As a part of Internal Evaluation

1. Seminar/ Professional Presentation

2. A Report on the same has to be prepared and presented.

** Teachers may use their discretion to choose topics relevant and suitable to the needs of students.*

** Not more than two students to work on each mini project.*

** Students may be assessed by their performance both in oral presentation and written report.*

Outcomes

- 👉 Accomplishment of sound vocabulary and its proper use contextually.
- 👉 Develop Flair in Writing and felicity in written expression.
- 👉 Generate Enhanced job prospects.
- 👉 Develop the Effective Speaking Abilities.
- 👉 Develop the activities on group discussion activities.
- 👉 Create the interview skills

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B.Tech. - III Year – II Semester		L	T	P	C
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(R22MED3269) INDUSTRY ORIENTED MINI PROJECT/ INTERNSHIP					

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B.Tech. - III Year – II Semester

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(R22MAC1110) ENVIRONMENTAL SCIENCE

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations

Course Outcomes:

- Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT-I

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT-II

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT-III

Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

UNIT-V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. **EIA:** EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

- 1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
- 2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS.Publications.

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B.Tech. - IV Year – I Semester

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— (R22MED4111) INDUSTRIAL MANAGEMENT

Objectives:

This course is intended to familiarise the students with the framework for the managers and leaders available for understanding and making decisions relating to issues related organisational structure, production operations, marketing, Human resource Management, product management and strategy.

UNIT I:

Introduction to Management: Entrepreneurship and organization - Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management

UNIT II:

Designing Organizational Structures: Departmentation and Decentralization, Types of Organization structures - Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

UNIT III:

Operations Management: Objectives- product design process- Process selection-Types of production system(Job, batch and Mass Production),-Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts-Design of product layout- Line balancing(RPW method)
Value analysis-Definition-types of values- Objectives- Phases of value analysis- Fast diagram

UNIT IV:

Work Study: Introduction – definition – objectives – steps in work study – Method study –definition – objectives – steps of method study. Work Measurement – purpose – types of study – stop watch methods – steps – key rating – allowances – standard time calculations – work sampling.
Statistical Quality Control: variables-attributes, Shewart control charts for variables- \bar{x} chart, R chart, - Attributes-Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

UNIT V:

Job Evaluation : methods of job evaluation – simple routing objective systems – classification method – factor comparison method – point method – benefits of job evaluation and limitations.
Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems)

TEXT BOOKS:

1. Industrial Engineering and Management/O.P. Khanna/Khanna Publishers.
2. Industrial Engineering and Management Science/T.R. Banga and S.C.Sarma/Khanna Publishers.

REFERENCE BOOKS:

1. Motion and Time Study by Ralph M Barnes/ John Willey & Sons Work Study by ILO.
2. Human factors in Engineering & Design/Ernest J McCormick / TMH.
3. Production & Operation Management /Paneer Selvam /PHI.
4. Industrial Engineering Management/NVS Raju/Cengage Learning.
5. Industrial Engineering Hand Book /Maynard.
6. Industrial Engineering Management / RaviShankar/ Galgotia.

Course Outcome

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

1. List, justify and interpret productivity models in manufacturing and service organization.
2. Judge product development and industrial process design.
3. Predict facility location and network models.
4. Interpret and solve data from aggregate output planning models. Knowledge of human factors in engineering and various jobs designs.
5. Select and analyze an inventory control model based upon given data. Understanding of manufacturing resource and just-in-time planning.
6. To understand and control the quality of an end product and the methods of job evaluation, project management by using CPM and PERT.

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B.Tech. - IV Year – I Semester

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(R22MED4112) REFRIGERATION & AIR CONDITIONING

Course Objectives:

1. The purpose of this course is to impart adequate knowledge in both practice and theory.
2. The course structures covers various types of Refrigeration Systems to familiarize the students with the fundamentals of Refrigeration and Air Conditioning Systems.
3. After the completion of this course the students will be acquainted with the operation and maintenance/repair of different components of Refrigeration Systems.

UNIT – I

Introduction to Refrigeration: -Basic concepts - Unit of refrigeration and C.O.P-refrigerators-heat pump- carnot refrigerator-applications of refrigerator – Vapour compression refrigeration- Ideal cycle – effect of sub cooling of liquid- super heating of vapour-deviations of practical (actual cycle) from ideal cycle- construction and use of P-H chart- problems.

UNIT – II

Components :

Compressors –classification – Working – Advantages and Disadvantages.

Condensers – classification – Working Principles

Evaporators – classification – Working Principles

Expansion devices – Types – Working Principles

UNIT III:

Vapor Absorption refrigeration – Description and working of ammonia – water, Li Br – water system – Calculation of HCOP, Principle and operation of three fluid vapour absorption refrigeration system.

Air refrigeration- Bell Coleman cycle – open and dente air system - ideal and actual refrigeration – applications – steam jet refrigeration system – working principle – basic operation

UNIT – IV:

Introduction to Air Conditioning:

Psychometric Properties & Processes – Sensible and latent heat loads – Characterization – Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, ASHF, ESHF and ADP.

Concept of human comfort and effective temperature –Comfort Air conditioning – Industrial air conditioning and Requirements – Air conditioning Load Calculations.

UNIT – V:

Air Conditioning systems: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, deodorants, fans and blowers.

Heat Pump – Heat sources – different heat pump circuits – Applications.

TEXT BOOKS:

1. Refrigeration and Air Conditioning / CP Arora / TMH.
2. A Course in Refrigeration and Air Conditioning / SC Arora & Domkundwar / Dhanpatrai.

REFERENCE BOOKS:

1. Principles of Refrigeration /Dossat / Pearson Education.
2. Basic Refrigeration and Air-Conditioning/ Ananthanarayanan / TMH.

3. Refrigeration and Air Conditioning/ Manohar Prasad/ New Age.
4. Refrigeration and Air Conditioning/Ahmadul Ameen/PHI.

Course Outcomes:

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

1. Explain different types of Basic Refrigeration cycles and its applications in multi compressor and multi evaporator systems.
2. Describe the methods for low temperature refrigeration.
3. Propose the selection and design of different components of Refrigeration systems.
4. Describe functioning of different kind of heat energy operated vapour absorption systems.
5. Recommend the selection and application of suitable/eco-friendly refrigerants.
6. Classify Air conditioning systems and study of heat pump.

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L	T	P	C
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Professional Elective - II

(R22CSM4142) ARTIFICIAL INTELLIGENCE IN MECHANICAL ENGINEERING

Course Objectives:

- To provide a basic foundation on different concepts of Artificial Intelligence.
- To investigate various applications of AI such as Virtual Assistants, Computer Vision, as well as other Smart Applications.
- Explore the scope, advantages as well as limitations of intelligent systems.
- Experiment with different machine learning concepts such as Deep Learning and Reinforcement Learning
- To expose students to the AI-intensive computing and information system frameworks.

UNIT-I: Introduction to Artificial Intelligence:

Basics of AI. Applications of AI. Advanced search, Constraint satisfaction problems, Knowledge representation & reasoning, Non-standard logics, Uncertain and probabilistic reasoning. Conceptual introduction to Machine Learning: Introduction to Neural Networks, Supervised, Unsupervised, and Semi-Supervised Learning, Deep Learning, Reinforcement Learning, Linear Regression. Conceptual introduction to Natural Language Processing: Natural language Understanding, Sentiment Analysis, Segmentation and recognition. Conceptual introduction to Speech Recognition & Synthesis: Speech Fundamentals, Speech Analysis, Speech Modelling, Speech Recognition, Speech Synthesis, Text-to-Speech. Conceptual introduction to Image Processing & Computer Vision: Introduction to Image processing, Image Noise, Removal of Noise from Images, Color Enhancement, Segmentation, Edge Detection, Optical Character Recognition, Feature Detection & Recognition

UNIT-II: BOT Technologies and Virtual Assistants:

Catboats: Introduction to a Chatbot, Architecture of a Chatbot. NLP in the cloud, NL Interface, how to Build a Chatbot, Transformative user experience of catboats, Designing elements of a Chatbot, Best practices for Chatbot development. NLP components. NLP wrapper to catboats. Audiobots and Musicbots. Virtual Assistants: Architecture of a Virtual Assistant.

UNIT-III: Image Processing & Computer Vision:

Image - Definition and Tagging. Classification of images. Tagging. Image formation, Deep Learning algorithms for Object detection & Recognition. Face recognition, Instance recognition, Feature detection and matching, Segmentation, Recognition Databases and test sets Applications - Feature extraction, Shape identification. Face detection. Applications: Automation, Agriculture [Crop and Soil Monitoring, grading farm produce, Predictive Analytics], Retail and Retail Security [Amazon Go], Autonomous vehicles.

UNIT-IV: Reinforcement Learning:

Introduction to Reinforcement Learning, Game Playing Deep Blue in Chess, IBM Watson in Jeopardy, Google's Deep Mind in AlphaGo, Agents and Environment, Action-Value Function, Deep Reinforced Learning Applications: Robotics, Gaming, Diagnostic systems, Virtual Assistants.

UNIT-V: Smart Applications:

Smart Manufacturing, Smart Agriculture, Smart Healthcare, Smart Education, Smart Grids, Smart Transportation and Autonomous Vehicles, Smart Homes, Smart Cities.

TEXT BOOKS:

1. Tom Markiewicz & Josh Zheng, Getting started with Artificial Intelligence, O'Reilly Media, 2017.
2. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach., Prentice Hall

REFERENCE BOOKS:

1. AurélienGéron, Hands on Machine Learning with Scikit-Learn and Tensor Flow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media, 2017.
2. Build an AI Assistant with Wolfram Alpha and Wikipedia in Python. <https://medium.com/@salisuwy/build-an-ai-assistant-with-wolfram-alpha-andwikipedia-in-python-d9bc8ac838fe>
3. Joseph Howse, Prateek Joshi, Michael Beyeler - Opencv_ Computer Vision Projects with Python-Packt Publishing (2016).
4. Curated Datasets on Kaggle<https://www.kaggle.com/datasets>.

Learning Outcomes: After completion of this unit, the student will be able to

- recognize various domains in which AI can be applied
- define machine learning and forms of learning
- describe natural language processing and concepts for converting speech to different forms
- identify the concepts of image processing
- analyze the architecture of a Chatbot
- illustrate how to construct a Chatbot
- differentiate various catboats
- interpret the architecture of a virtual assistant
- classify the properties of images
- interpret the concepts of image processing
- implement the methods in processing an image
- analyze and apply the concepts of image processing in automation and agriculture
- illustrate reinforcement learning
- employ the reinforcement learning in game playing
- use reinforcement learning in agent based environment
- practice learning process in diagnostic and virtual assistant systems
- understand the application of intelligence in various domains
- apply the artificial intelligence in various applications
- correlate the intelligence to advanced applications

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Professional Elective - II (R22MED4141) INDUSTRIAL ROBOTICS

Objectives:

- 1) To acquire the knowledge on advanced algebraic tools for the description of motion.
- 2) To develop the ability to analyze and design the motion for articulated systems.
- 3) To develop an ability to use software tools for analysis and design of robotic systems.

UNIT – I

Introduction, Automation and Robotics – An over view of Robotics – classification by coordinate system and control systems

Components of the Industrial Robotics: Degrees of freedom – End effectors: Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General consideration on gripper selection and design, Robot actuator and sensors.

UNIT – II

Motion Analysis: Basic rotation matrices – Composite rotation matrices – Euler Angles – Equivalent Angle and Axis – Homogeneous transformation – Problems.

Manipulator Kinematics: D-H notations - Joint coordinates and world coordinates - Forward and inverse kinematics – problems.

UNIT – III

Differential Kinematics: Differential Kinematics of planar and spherical manipulators - Jacobians – problems.

Robot Dynamics: Lagrange – Euler formulations – Newton-Euler formulations – Problems on planar two link manipulators.

UNIT IV

Trajectory Planning: Joint space scheme – cubic polynomial fit – Avoidance of obstacles –

Types of motion: Slew motion - joint interpolated motion – straight line motion – problems.

Robot actuators and Feed back components: Actuators: Pneumatic.

UNIT V

Robot Application in Manufacturing: Material handling - Assembly and Inspection – Work cell design, work volume, Robot screen.

TEXT BOOKS :

1. Industrial Robotics / Groover M P / Pearson Edu.
2. Introduction to Robotic Mechanics and Control / JJ Craig/ Pearson/ 3rd edition.

REFERENCES :

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klaftez/ Prentice Hall.
3. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.
4. Robot Dynamics & Control/Mark W. Spong and M. Vidyasagar / John Wiley & Sons (ASIA) Pvt. Ltd.
5. Robotics and Control / Mittal R K & Nagrath I J / TMH.

Outcomes:

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

- 1) Use matrix algebra for computing the kinematics of robots.
- 2) Calculate the forward kinematics and inverse kinematics of serial and parallel robots.
- 3) Calculate the Jacobian for serial and parallel robot.
- 4) Demonstrate the path planning for a robotic system.
- 5) Study of different numerical methods.
- 6) Describe the robot Application in manufacturing.

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Professional Elective - II (R22MED4142) MECHATRONICS

UNIT-I Mechatronics systems, elements, levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT-II Solid state electronic devices, PN junction diode, BJT, FET, DIA and TRIAC. Analog signal conditioning, amplifiers, filtering. Introduction to MEMS & typical applications.

UNIT-III Hydraulic and pneumatic actuating systems, Fluid systems, Hydraulic and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems: Mechanical actuating systems and electrical actuating systems.

UNIT-IV Digital electronics and systems, digital logic control, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT-V System and interfacing and data acquisition, DAQS, SCADA, A to D and D to A conversions; Dynamic models and analogies, System response. Design of mechatronics systems & future trends.

TEXT BOOKS:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran & GK Vijaya Raghavan/WILEY India Edition/2008
2. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/ W Bolton/ Pearson Education Press/3rd edition, 2005.

REFERENCES:

1. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
3. Mechatronics System Design / Devdas shetty/Richard/Thomson.
4. Mechatronics/M.D.Singh/J.G.Joshi/PHI. 5. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition, Pearson, 2012 W. Bolton 6. Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlseviev, 2006 Indian print.

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Professional Elective - II
(R22MED4143) AUTOMOBILE ENGINEERING

Course Objectives:

The purpose of this course is to impart adequate knowledge in both practically and theoretically, covering the various types of power-driven vehicles and to familiarize the students with the fundamentals of Automotive Engine System, Chassis and suspension system, braking and transmission system, and cooling system. The students are acquainted with the operation, maintenance and repairs of all components of the various transportation vehicles.

UNIT – I

Introduction : Layout of automobile – introduction chassis and body components . types of Automobile engines. – power unit – Introduction to engine lubrication – engine servicing.

Fuel System : S.I. Engine : Fuel supply systems, Mechanical and electrical fuel pump – filters – carburettor – types – air filters – petrol injection. Introduction to MPFI and GDI Systems.

C.I. Engines : Requirements of diesel injection systems, types of injection systems, DI Systems IDI systems. fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps. Introduction CRDI and TDI Systems.

UNIT – II

Cooling System : Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporative cooling – pressure sealed cooling – antifreeze solutions.

Ignition System : Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

Electrical System : Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT – III

Transmission System : Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, constant mesh, synchro mesh gear boxes, epicyclic gear box , over drive, torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

Suspension System : Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

UNIT – IV

Braking System : Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder, tandem master cylinder, Requirement of brake fluid, Pneumatic and vacuum brakes.

Steering System : Steering geometry – camber, caster, king pin inclination, combined angle, toe-in, toe-out, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

UNIT – V

Emissions from Automobiles – Pollution standards National and international – Pollution Control – Techniques – Multipoint fuel injection for SI Engines. Common rail diesel injection, Energy alternatives – Solar, Photo-voltaic, hydrogen, Biomass, alcohols, LPG, CNG, liquid Fuels and gaseous fuels, Hydrogen as a fuel for IC Engines. - their merits and demerits. Standard Vehicle maintenance practice.

TEXT BOOKS :

1. Automobile Engineering / William H Crouse/McGraw Hill-2012.
2. A Text Book Automobile Engineering–Manzoor, Nawazish Mehdi & Yosuf Ali, Frontline Publications.

REFERENCES :

1. A Text Book of Automobile Engineering by R K Rajput. Laxmi Publications.
2. Automotive Mechanics / Heitner.
3. Automotive Engineering / Newton Steeds & Garrett.
4. Automotive Engines / Srinivasan.
5. A Text Book of Automobile Engineering By Khalil U Siddiqui New Age International.
6. Automobile Engineering by Dr. Kripal Singh- Vol. 1 and 2.

Course Outcomes:

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

1. List different types of Engine and their classifications.
2. To understand the firing order for multi-cylinder engines for igniting of fuels.
3. Develop concept and define working of Automobile Engine cooling and lubrication system.
4. To understand the cooling system, ignition system of the IC engines
5. To understand the transmission of the power transmission system of automobiles, suspension system of the automobiles including the rigid axle of the automobiles.
6. To understand the mechanical braking system of the automobiles, types of the steering.

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Professional Elective - III
(R22MED4144) COMPOSITE MATERIALS

Course Objectives :

1. Ability to solve mechanics of composite materials problems using classical methods
2. Ability to do research and present on an advanced material topic

UNIT-I

Introduction to Composite Materials: Introduction ,Classification Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber-Reinforced Composites and nature-made composites, and applications .

UNIT-II

Reinforcements: Fibers- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide fibers. Particulate composites, Polymer composites, Thermoplastics, Thermosets, Metal matrix and ceramic composites.

UNIT-III

Macro Mechanical Analysis of a Lamina: Introduction, Definitions Stress, Strain, Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials, Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

UNIT-IV

Macro Mechanical Analysis of Laminates: Introduction , Laminate Code , Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus.

UNIT-V

Failure Analysis of Laminates: Introduction, Special Cases of Laminates, Applications, Failure Criterion for a Laminate.

TEXT BOOKS:

1. Mechanics of Composite Materials/ R. M. Jones/ Mc Graw Hill Company, New York, 1975.
2. Engineering Mechanics of Composite Materials/Isaac and M Daniel/ Oxford University Press, 1994.

REFERENCES:

1. Analysis and performance of fibre Composites/ B. D. Agarwal and L. J. Broutman/ Wiley- Inter science, New York, 1980.
2. Mechanics of Composite Materials/ Second Edition (Mechanical Engineering)/ Autar K. Kaw/Publisher: CRC.
3. Analysis of Laminated Composite Structures/ L. R. Calcote/ Van Nostrand Reinhold, New York, 1969.
4. Advanced Mechanics of Composite Materials/ Vasiliev &Morozov/ Elsevier/Second Edition

Course Outcomes

1. Some understanding of types, manufacturing processes, and applications of composite materials
2. Ability to analyze problems on macromechanical behavior of lamina
3. Ability to analyze problems on micromechanical behavior of lamina
4. Ability to analyze problems on macromechanical behavior of laminate
5. Ability to analyze problems on bending, buckling, and vibration of laminated plates and beams
6. Ability to understand the failure behavior of laminates

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Professional Elective - III
(R22MED4145) COMPUTATIONAL FLUID DYNAMICS

Objective of the course:

1. Understanding the basic equations of fluid mechanics (Navier-Stokes equations)
2. Understanding the implementation of the equations in a CFD code
3. Choosing different models for flow simulations (turbulence models, etc.)
4. Critical evaluation of CFD-solutions
5. Applying CFD for the purposes of research and development

UNIT-I

Elementary details in numerical techniques: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition for instability, computational methods for error estimation, convergence of sequences.

Applied Numerical Methods: Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix Inversion, Direct Methods for Matrix inversion, Direct Methods for banded matrices.

UNIT - II

Finite Difference Applications in Heat conduction and Convection – Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modeling: Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT - III

Introduction to first order wave equation; Stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

UNIT - IV

Review of Equations Governing Fluid Flow and Heat Transfer: Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier-stokes equations.

UNIT-V

Finite volume method: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TEXT BOOKS:

- 1) Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
- 2) Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications.

REFERENCES:

- 1) Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.
- 2) Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities Press.
Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis/Oxford University Press/2nd Edition.

Course Outcomes

1. To understand the basic concepts of Elementary details in numerical techniques, Applied Numerical Methods
2. To understand the basic concepts of Finite Difference Method and its Applications in Heat conduction and Convection
3. To know the Introduction to first order wave equation.
4. To know the basic Equations Governing Fluid Flow and Heat Transfer
5. To know the basic Equations in the Finite volume method
6. To understand the applications of CFD.

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Professional Elective - III
(R22MED4146) PRODUCTION PLANNING & CONTROL

Objectives:

1. To plan production facilities in the best possible manner along with the proper systematic planning of production activities.
2. Providing men, machines, materials etc. of right quality, quantity and also providing them at the right time forms a very important factor and Japanese concepts of the inventory control.
3. To inform, about the difficulties or the various awkward positions expected to crop up later, to the management beforehand.
4. Involves order preparation, process planning or routing concerns, fixation of method of manufacture, scheduling, dispatching, progressing, expediting etc.
5. Involves cost estimation, work measurement, subcontracting, capacity planning and demand forecasting etc.

UNIT-I

Introduction: Definitions – objectives of production planning and control-functions of production planning and control-elements of production control-types of production- organization of production planning and control – internal organizations department

UNIT-II

Forecasting – Importance of forecasting – types of forecasting, their uses-general principles of forecasting techniques- Qualitative methods and quantitative methods.

UNIT-III

Inventory management – Functions inventory- Relevant inventory cost- ABC analysis- VED Analysis- EOQ model – Inventory control systems – P- Systems and Q – Systems
Introduction to MRP And ERP, LOB(Line of balance), JIT inventory, Japanese concepts.

UNIT- IV

Routing – Definition – routing procedure- Route sheets – Bill of material-factors affecting routing procedure. Schedule – definition – difference with loading.
Scheduling polices – techniques, standard scheduling methods- job shop, flow shop,.
Line balancing, aggregate planning- methods for aggregate planning- Chase planning, expediting, control aspects.

UNIT-V

Dispatching – Activities of dispatcher- Dispatching procedure - follow up – definition – reasons for existence of functions – types of follow up, applications of computer in production planning and control

TEXT BOOKS:

1. Production Planning and Control/ M.Mahajan/ Dhanpati rai & Co.
2. Production Planning and Control/ Jain & Jain/ Khanna publications

REFERENCE BOOKS :

- 1) Production Planning and Control- Text & cases/ SK Mukhopadhyaya /PHI.
- 2) Production and operations Management/ R.Panneer Selvam/PHI.
- 3) Operations Management/Chase/PHI.
- 4) Operations management/ Heizer/Pearson.
- 5) Production and Operations Management(Theory and Practice) / Dipak Kumar Bhattacharyya / University Press.
- 6) Operations Management/S.N. Chary/TMH.

Course Outcomes

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

- 1 Design of production/operating system.
- 2 Develop forecasts using forecasting techniques and choose a location.
- 3 Choose a facility layout and perform work measurement.
- 4 Explain capacity planning, materials management and inventory management.
- 5 Explain the master production schedule, shop floor planning and control and material management.
- 6 Explain advanced softwares related production planning & control

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Professional Elective - III
(R22MED4147) SOLAR ENERGY TECHNOLOGY

UNIT-I: Solar Energy Technology:

Introduction – Solar energy option, specialty and potential – sun – earth – solar radiation-beam and diffuse – measurement-estimation of average solar radiation on horizontal and titled surfaces – problems – applications.

UNIT-II: Capturing solar radiation:

Physical principle of collection – types – liquid flat plate collectors – construction details – performance analysis – concentrating collection – flat plate collector with plane reflectors – cylindrical parabolic collectors – orientation and tracking – performance analysis.

UNIT-III: Power generation:

Solar central receiver system – heliostats and receiver – heat transport system – solar distributed receiver system – power cycles – working fluids and prime movers

UNIT-IV: Thermal energy storage:

Introduction – need for storage – methods of sensible heat storage using solids and liquids – packed bed storage – latent heat storage – thermo chemical storage solar pond – working principle – construction application and limitations.

UNIT-V: Direct energy conversion:

Solid state principles- semiconductors-solar cells-performancemodular construction-applications

Other solar devices: stills – air heaters- driers Economics: Principles of economic analysis – discounted cash flow – solar system – life cycle costs – cost benefit analysis and optimization-cost based analysis of water heating and photovoltaic applications

REFERENCE BOOKS:

1. G.D.Rai” Solar Energy Utilization”Khanna Publishers
2. H.P.Garg & I.Prakash”Solar Energy”-Fundamentals and application –Wiley Interscience
3. D.Y.Goswami.F.Kreith and I.F.Kreider. Principle of Solar Engineering, Taylor and Francis, Philadelphia
4. Kaushik S.C.Tiwari G.N. and Nayak I.K ”Thermal control in passive solar buildings”
5. S.P.Sukhatme, Solar Energy-Principles of thermal collection and storage, second edition, Tata McGraw-Hill, New Delhi.

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Professional Elective - IV (R22MED4149) RENEWABLE ENERGY SOURCES

Course Objectives

The course should enable the students to :

1. Understand the various forms of conventional energy resources.
2. Learn the present energy scenario and the need for energy conservation
3. Explain the concept of various forms of renewable energy
4. Outline division aspects and utilization of renewable energy sources for both domestic and industrial application
5. Analyze the environmental aspects of renewable energy resources.

UNIT – I Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power - Physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, Solar radiation on tilted surface, Instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT – II Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Solar Energy Storage and Applications: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications - solar heating/ cooling techniques, solar distillation and drying, Photovoltaic energy conversion.

UNIT – III Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics.

Bio-Mass: Principles of Bio-Conversion, Anaerobic /aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation, and economic aspects.

UNIT – IV Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

OTEC : Principles, utilization, setting of OTEC plants, thermodynamic cycles.

Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, their economics.

UNIT –V Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, Principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principle, faraday's laws, thermodynamic aspects, selection of fuels and operating conditions.

Text Books:

- 1) Renewable Energy Sources / Twidell & Weir / Taylor and Francis / 2nd Special Indian Edition.
- 2) Non- conventional Energy Sources / G.D. Rai / Dhanpat Rai and Sons.

Reference Books:

- 2) Energy Resources Utilization and Technologies / Anjaneyulu & Francis / BS Publications/2012.
- 3) Principles of Solar Energy / Frank Krieth & John F Kreider / Hemisphere Publications.
- 4) Non-Conventional Energy / Ashok V Desai / Wiley Eastern.
- 5) Non-Conventional Energy Systems / K Mittal / Wheeler.
- 6) Renewable Energy Technologies / Ramesh & Kumar / Narosa.
- 7) Renewable Energy Resources / Tiwari and Ghosal / Narosa.

Outcomes of the course:

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

- 1 Explain the working principle of solar energy& radiation.
- 2 Describe the working principle of wind energy and their classification.
- 3 Classify different types of Geo thermal energy sources and their principles.
- 4 Categorize the principles of biomass conversion and its applications.
- 5 Explain the principles and utilization of OTEC plants.
- 6 Analysis of Direct energy conversion and their effects.

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Professional Elective - IV

(R22MED4148) FUNDAMENTALS OF ELECTRIC AND HYBRID VEHICLES

Course Objectives :

- Vehicle is an unavoidable machine for the industry, individual and government.
- The fuel consumptions have led the nations to be dependent on electric vehicles and needs a major change in the operation in context to energy saving.
- The electric vehicle has drawn attention of the designers, researchers and manufacturers for the skilled persons needed in this era.
- The energy saving concept has lead to hybrid electric vehicle in all the concepts for the transportation

UNIT – I: Introduction to Electric Vehicle:

History of Electric Vehicles, Development towards 21st Century, Types of Electric Vehicles in use today – Battery Electric Vehicle, Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles. Motion and Dynamic Equations of the Electric Vehicles: various forces acting on the Vehicle in static and dynamic conditions.

UNIT-II: Induction to Hybrid Electric Vehicle:

Social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid Drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis

UNIT- III: Electric Drive Trains:

Basic concept of electric traction, introduction to various electric drivetrain topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT-IV: Types of Storage Systems:

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Calculation for the ratings.

UNIT-V: Modelling of Hybrid Electric Vehicle Range:

Driving Cycles, Types of Driving Cycles, Range modelling for Battery Electric Vehicle, Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles.

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Introduction to various charging techniques and schematic of charging stations.

Reference Books:

1. James Larminie, J. Lowry, “Electric Vehicle Technology Explained”, John Wiley & Sons Ltd. 2003.
2. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.
3. S. Onori, L. Serrao and G. Rizzoni, “Hybrid Electric Vehicles: Energy Management Strategies”, Springer, 2015.
4. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2003.

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Professional Elective - IV
(R22MED4165) RE-ENGINEERING

Course Objectives

- To understand concepts and philosophy of Business Process Reengineering.
- To learn various BPR and alternate methodologies – TQM, Work Study, ISO standards practiced in the industry.
- To understand and analyze the role of Information Technology and change management in the implementation of BPR.
- To expose practically BPR implementation and best practices through research papers and case discussions.

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

- Understanding various BPR methodologies and their applications.
- Understanding the critical success factors for implementing BPR.
- Appreciate various alternative techniques of BPR – TQM, Work Study, Benchmarking and their applications.
- Basic understanding of ISO standard 9001:2015, IACBE and their applications in education and industry.
- Analyze and integrate issues and challenges of applying tools/techniques of Information Technology for BPR and learn to apply them in the industry.
- Familiarizing, analyzing and applying the role of process of Change Management in implementing BPR.

UNIT-I: PROCESS VIEW OF BUSINESS :

Definition and Dimensions of Business Process, Generic Process Framework, The Capability Maturity Model Integration (CMMI), Design Process and Design Quality, Requirement Engineering, Design Concepts

UNIT-II: BPR: METHODOLOGIES AND TECHNIQUES & APPLICATIONS:

Introduction and History of BPR, Definition and Benefits of BPR, BPR Model, BPR Methodology Selection Guidelines, Steps to implement BPR: Reengineering Approaches :a) Big Bang Approach, b) Incremental Approach, c) Evolutionary Approach, BPR Methodologies: a) Hammer/Champy Methodology, b) Davenport Methodology, c) Manganelli/Klein Methodology, d) Kodak Methodology; Comparison of various methodologies. Case: Dabbawala of Mumbai, A Case Analysis using BPR methodologies Case: “Re-engineering the construction delivery process, The Museum of Tropical Queensland, Townsville” by R. Kennedy and A. Sidwell.

UNIT-III: CRITICAL SUCCESS FACTORS ANALYSIS:

Reengineering Success Factors, Risks associated with BPR, Barriers to BPR, Case: Analysis on “Pillsbury: Customer Driven Reengineering”, Barriers Management, Case: “Walmart China- Supply Chain Transformation”

UNIT-IV: BPR Vs OTHER IMPROVEMENT APPROACHES:

Optimization Techniques, Process Simplification, Case: “Aviation Spare Parts Supply Chain Management Optimization at Cathay Pacific Airways Ltd”. TQM: ISO 9000 – QMS/EMS/IMS, Quality Policy, Quality Manual, SIPOC, Procedure Manual, Work Sheets, Quality Audit, Six Sigma, QMS, ISO in Higher Education Institutions, IACBE Accreditation in Education, Restructuring, 5 S Technique, Benchmarking, Work Study, Knowledge Management

UNIT-V: INFORMATION TECHNOLOGY AND BPR:

Role of IT in Reengineering, Criticality of IT in Business Process, BPR Team Characteristics, Threads of BPR in Various Phases, Case: “Otis Elevator: Accelerating Business Transformation with IT”, BPR, SAP and ERP, Elements of ERP, Applications of ERP

Text Books

1. R. Radhakrishnan, S. Balasubramanian. (2010). Business Process Reengineering, Text and Cases. Prentice Hall of India, New Delhi.

Reference Books

1. Dimitris, N. Chorafas. Integrating ERP, CRM, Supply Chain Management and Smart Materials. ISBN 0-8493-1076-8
2. Jayanti Natarjan. (2002). Business Process Reengineering. TMH, New Delhi,
3. Kapoor Rajneesh. (2001). Business Process Redesign. Global Business Press, Delhi.
4. Richard Johnson Management, (2001). Processes for Quality Operations. Vision Books.
5. Roger S. Pressman (2005). Software Engineering – A Practitioner’s Approach, 6th Edition. Mcgraw-Hill International Edition..
6. Siddiqui Moid & Khwaja R.H. (2010). The Acrobatics of Change, 7th Reprint. Sage Publications India Pvt. Ltd. New Delhi.

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Professional Elective - IV
(R22MTH4145) OPERATIONS RESEARCH

Objectives :

Students will be exposed to allocation problem, Linear Programming, Assignment, Theory of games, Inventory, Waiting Lines and Dynamic Programming.

UNIT – I

Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method.

UNIT – II

Transportation Problem – Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.

Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem- Traveling Salesman problem.

UNIT – III

Sequencing – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through ‘m’ machines

Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

UNIT – IV

Theory of Games: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

Inventory: Introduction – Single item, Deterministic models – Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand may be discrete variable or continuous variable – Single Period model and no setup cost.

UNIT – V

Waiting Lines: Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.

Dynamic Programming:

Introduction – Terminology- Bellman’s Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

Simulation: Introduction, Definition, types of simulation models, Steps involved in the simulation process- Advantages and disadvantages-applications of simulation to queuing and inventory.

TEXT BOOKS :

2. Operations Research /J.K.Sharma 4e. /MacMilan.
3. Introduction to O.R/Hillier & Libermann/TMH.

REFERENCE BOOKS :

1. Introduction to O.R /Taha/PHI.
2. Operations Research/ NVS Raju/ SMS Education/3rd Revised Edition.
3. Operations Research /A.M.Natarajan, P.Balasubramaniam, A. Tamilarasi/Pearson Education.
4. Operations Research / Wagner/ PHI Publications.
5. Operations Research/M.V. Durga Prasad, K, Vijaya Kumar Reddy, J. Suresh Kumar/ Cengage Learning.

Course Outcomes:

After taking this course the students should be able to

- 1 Identify necessity and development of mathematical models for various industries.
- 2 Describe basic optimization and simulation techniques applied to various industries.
- 3 Recall investment analysis and game theory.
- 4 Propose a queuing model based upon given data.
- 5 Define the different types of simulation models.
- 6 Explain the types of inventory models.

Open Elective –II

S. No.	Course Code	Course Title	L	T	P	Credits
1	R22CIV4136	Green Building Engineering	3	0	0	3
2	R22CSC3235	Cyber Security Fundamentals				
3	R22ECE4134	Principles of Modern Communication Systems				
4	R22EEE3234	Illumination Engineering				
5	R22INF3234	E-Commerce				
6	R22MED3236	Industrial Design & Ergonomics				
7	R22HMS3234	Creative Writing				
8	R22HMS3236	Design Thinking				

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L	T	P	C
3	0	0	3

(R22CIV4136) GREEN BUILDING ENGINEERING

Course Outcomes: On successful completion of this course the student will be able to:

1. Describe the concepts of Green building
2. Adopt Renewable energy for buildings.
3. Implement Automation techniques in buildings.
4. Describe Actuator techniques for Automation
5. Choose appropriate materials for Green buildings

UNIT 1 Concept of Green Buildings : Green building initiatives, its origin, characteristics of a green building, green buildings in India, certification of green buildings.Criteria for rating – sustainability. Depleting natural resources of building materials; renewable and recyclable resources; energy efficient materials; green cement, biodegradable materials, smart materials, engineering evaluation of these materials. Case study.

UNIT 2 Sources of Energy Renewable and non-renewable sources of energy ; coal, petroleum, nuclear, wind, solar, hydro, geothermal sources; potential of these sources, hazards, pollution; global scenario with reference to demand and supply in India. Energy arises. Carbon Emission: Forecasting, control of carbon emission, air quality and its monitoring carbon foot print; environmental issues, minimizing carbon emission.

UNIT 3 - Intelligent Buildings Intelligent buildings-Building automation-Smart buildings- Building services in high rise buildings-Green buildings-Energy efficient buildings for various zones-Case studies of residence, office buildings and other buildings in each zones. Case Study.

UNIT 4 Actuator Techniques Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magneto structure Material – Shape Memory Alloys – Electrorheological Fluids– Electromagnetic actuation – Role of actuators and Actuator Materials.

UNIT 5 Materials For "Green" Systems Green materials, including biomaterials, biopolymers, bioplastics, and composites Nanotech Materials for Truly Sustainable Construction: Windows, Skylights, and Lighting. Paints, Roofs, Walls, and Cooling.Multifunctional Gas Sensors, Biomimetic Sensors, Optical Interference Sensors Thermo-, light-, and stimulus-responsive smart materials.

TEXT BOOKS

1. Sustainable Construction , Charles J. Kibert.,Third Edition
2. Green Building A to Z, Jerry Yudelson.

REFERENCE BOOKS

1 Advanced Technology for Smart buildings,James Sinopoli

E BOOKS <https://www.springer.com/in/book/9789811010002>

<https://www.elsevier.com/books/smart-buildings/casini/978-0-08-100635-1>

MOOC<https://www.mooc-list.com/tags/green-building>

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OPEN ELECTIVE - II

L	T	P	C
3	0	0	3

(R22CSC3235) CYBER SECURITY FUNDAMENTALS

Course Objectives:

1. Understand the need for Cyber security and its related threats and attacks
2. Learn methods to become secure in the cyber world and securely communicate in the cyber world
3. Become knowledgeable about the best practices related to cyber security, regulations and laws associated with the same.

Course Outcomes:

The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context

UNIT I: Need for Cyber Security - Introduction to security- CIA triad-Case studies- security attacks-issues related to social networking - Guidelines

UNIT II: Methods to Secure yourself in the Cyber World - Why and What of Reversible and Irreversible Cryptographic mechanisms? Applications of Digital Signature - Good password practices

UNIT III: E-Commerce: Secure Transactions - What is E-commerce? – Online banking security- Online shopping fraud Guidelines and Recommendations

UNIT IV: EVERYDAY SECURITY - Connecting your laptop, mobile devices, PDAs to Internet-Managing your browser-Facebook Security-E-mail security – Safe guarding from Viruses: Antiviruses– Best practices and guidelines

UNIT V: CYBER SECURITY LAWS AND COMPETENT AUTHORITIES - Indian IT Act, 2008 - What is Cyber Forensics? – Functions of cybercrime cell – Responding to a cyber-attack

REFERENCES:

1. “Information Security Awareness Handbook, ISEA, Department of Electronics and Information Technology”, Government of India, 2010
2. deity.gov.in/sites/upload_files/dit/.../itact2000/it_amendment_act2008.pdf
3. www.schneier.com/blog/archives/2013/03/browser_security.html
4. www.dhses.ny.gov/ocs/awareness-training-events/news/2010-03.cfm
5. <https://www.watsonhall.com/e-commerce-security/>

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OPEN ELECTIVE - II

L	T	P	C
3	0	0	3

(R22ECE4134) PRINCIPLES OF MODERN COMMUNICATION SYSTEMS

Course Objectives:

This course aims at:

- Establishing a firm foundation for the understanding of telecommunication systems, and the relationship among various technical factors when such systems are designed and operated
- To provide the student with an understanding of the mobile Cellular communications and their evolution.
- To equip the students with various kinds of wireless networks and its operations.
- To provide students with solid foundation in orbital mechanics and launches for the satellite communication
- Radar fundamentals and analysis of the radar signals

UNIT I: The evolution of electronic communication: From smoke signals to smart phones - History of communications: Theoretical Foundations, Development & Applications - Frequencies for communication - Frequency regulations - Overview of communication transmitter and receiver.

UNIT II: Mobile Cellular Communications: Evolution to cellular networks – Cellular systems generations and standards: 1G, 2G, 3G, 4G - Cellular network components - Components of a mobile phone - setting up a call process - Making a call process - Receiving a call process - Spectrum allocation: Policies and strategies, Role of TRAI.

UNIT III: Wireless Communication: Introduction - Bluetooth - Infrared communication - IEEE Wireless LANs (Wi-Fi) - IEEE 802.16 (WiMAX) - Future mobile and wireless networks: Introduction to 5G- device to device communication- IoT.

UNIT IV: Satellite: History of Satellite communication, Basics of Satellites, Types of Satellites, Capacity Allocation - Launch Vehicles and Orbits: Introduction to launching vehicles, Important Orbits, working of rocket, Three Pioneers of Rocketry - Basics of Global Positioning System (GPS) - Applications of GPS.

UNIT V:RADAR& NAVIGATION: Introduction, Radar Block diagram and Operation, Radar Frequencies, Applications of Radar. Navigation Systems: Introduction & methods of navigation, Instrument Landing System, Microwave landing system- Modern Navigation systems.

REFERENCES:

1. S.Haykin, —Communication Systems, 4/e, John Wiley 2007
2. B.P.Lathi, —Modern Digital and Analog Communication Systems, 3/e, Oxford University Press,2007
3. Rappaport Theodore S - Wireless Communications: Principles and Practice, 2/E, Pearson
4. Education India, 2010 5. Vijay. K. Garg, —Wireless Communication and Networking, Morgan Kaufmann Publishers, 2007.
5. T.Pratt, C. Bostian and J.Allnutt; —Satellite Communications, John Wiley and Sons, Second Edition., 2003
6. M. I .Skolnik —Introduction to Radar Systems, Tata McGraw Hill 2006.
7. Myron Kyton and W.R.Fried —Avionics Navigation Systems, John Wiley & Sons 1997.

Course outcomes

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

- C415.1. Differentiate various elements, processes, and parameters in communication systems, and describe their functions, effects, and interrelationship (K2-Understand).
- C415.2. Interpret the mobile cellular concepts, standards and all generations of cellular systems. (K2-understand)
- C415.3. Describe the existing and emerging wireless standards and Compare various wireless networks and their specifications. (K5-Evaluate)
- C415.4. Demonstrate the history of Satellite communication, applications and orbit concepts, Placement of a Satellite in a Geo-Stationary orbit and GPS concept (K3- Apply)
- C415.5 Summarize the radar fundamentals and analysis of the radar signals. (K4- Analyze)
- C415.6 Explain the Navigation systems (K2-Understand).

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OPEN ELECTIVE - II

L	T	P	C
3	0	0	3

(R22EEE3234) ILLUMINATION ENGINEERING

COURSE OBJECTIVES:

- To provide an introduction to the fundamentals of illumination engineering and architectural lighting design.
- To impart lighting fundamentals, measurement, and technology and their application in the analysis and design of architectural lighting systems

COURSE OUTCOME: The students will be able to:

- i. Identify the criteria for the selection of lamps and lighting systems for an indoor or outdoor space
- ii. Perform calculations on photometric performance of light sources and luminaires for lighting design
- iii. Evaluate different types of lighting designs and applications

UNIT I: Introduction of Light : Types of illumination, Day lighting, Supplementary artificial lighting and total lighting, Quality of good lighting, Factors affecting the lighting-shadow, glare, reflection, Color rendering and stroboscopic effect, Methods of artificial lighting, Lighting systems-direct, indirect, semi direct, semi indirect, Lighting scheme, General and localized.

UNIT II: Measurement of Light: Definition of luminous flux, Luminous intensity, Lumen, Candle power, Illumination, M.H.C.P, M.S.C.P, M.H.S.C.P, Lamp efficiency, Brightness or luminance, Laws of illumination, Inverse square law and Lambert's Cosine law, Illumination at horizontal and vertical plane from point source, Concept of polar curve, Calculation of luminance and illumination in case of linear source, round source and flat source.

UNIT III: Design of Interior Lighting : Definitions of maintenance factor, Uniformity ratio, Direct ratio, Coefficients of utilization and factors affecting it, Illumination required for various work planes, Space to mounting height ratio, Types of fixtures and relative terms used for interior illumination such as DLOR and ULOR, Selection of lamp and luminance, Selection of utilization factor, reflection factor and maintenance factor Determination of Lamp Lumen output taking into account voltage and temperature variations, Calculation of wattage of each lamp and no of lamps needed, Layout of lamp luminaire, Calculation of space to mounting height ratio, Indian standard recommendation and standard practices for illumination levels in various areas, Special feature for entrance, staircase, Corridor lighting and industrial building.

UNIT IV: Design of Outdoor Lighting: Street Lighting : Types of street and their level of illumination required, Terms related to street and street lighting, Types of fixtures used and their suitable application, Various arrangements in street lighting, Requirements of good street lighting, Selection of lamp and luminaire, Calculation of their wattage, Number and arrangement, Calculation of space to mounting height ratio, Calculation of illumination level available on road.

UNIT V:Design of Outdoor Lighting: Flood Lighting: Terms related to flood lighting, Types of fixtures and their suitable applications, Selection of lamp and projector, Calculation of their wattage and number and their arrangement, Calculation of space to mounting height ratio, recommended method for aiming of lamp.

Special Features of Aesthetic Lighting: Monument and statue lighting, Sports lighting, Hospital lighting, Auditorium lighting.

Text Books:

1. D.C. Pritchard Lighting, Routledge, 2016
2. Jack L. Lindsey, Applied Illumination Engineering, PHI, 1991
3. John Matthews Introduction to the Design and Analysis of Building Electrical Systems, Springer, 1993
4. M.A. Cayless, Lamps and Lighting, Routledge, 1996

References:

1. IS CODE 3646
2. IS CODE 6665

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L	T	P	C
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(R22INF3234) E – COMMERCE**COURSE OUTCOMES:** At the end of the course, the students will be able to :

1. Understand the E – commerce strategies and value chains
2. Understand the E-commerce services
3. Understand E - commerce infrastructure, its applications and Supply Chain Management.
4. Know the availability of latest technology and applications of E-Payment Mechanism.
5. Apply E-Commerce in business-to-business application.

UNIT 1: Electronic Commerce: Overview, Definition, Advantages & Disadvantages of E-Commerce, Threats of E-Commerce, Managerial Prospective, Rules & Regulation for Controlling Commerce, Relationship Between E-Commerce & Networking, Different Types of Networking for E-Commerce, internet, Intranet, EDI Systems, Wireless Application Protocol: Definition, Hand Held Devices, Mobility & Commerce Model, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement for E-Commerce, Business Model of E-Commerce; Model Based on Transaction Type, Model Based on Transaction Party- B2B, B2C, C2B, C2C, E-Governance.

UNIT 2: E-Strategy: Overview, Strategic Methods for developing E-Commerce. Four C's (Convergence, Collaborative, Computing, Content Management & Call Center). Convergence: Technological Advances in Convergence - Types, Convergence and its implications, Convergence & Electronic Commerce. Collaborative Computing: Collaborative Product Development, contract as per CAD, Simulations Collaboration, Security. Content Management: Definition of Content, Authoring Tools and Content Management, Content Management, Content - partnership, repositories, convergence, providers, Web Traffic.

UNIT 3: Traffic Management: Content Marketing Call Center: Definition, Need, Tasks Handled, Mode of Operation, Equipment, Strength & Weakness of Call Center, Customer Premises Equipment (CPE).

Supply Chain Management: E-logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution(SCE), SCEFramework, Internet's Effect on Supply Chain Power.

UNIT 4: E-Payment Mechanism: Payment through card system, E-Cheque, E-Cash, E-Payment, Threats& Protections.

E-Marketing: Home - Shopping, E-Marketing, Tele- Marketing

UNIT 5: Electronic Data Interchange (EDI): Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI, FACT/ GTDI), ANSIX-12, Data Encryption (DES/RSA)

Risks of E-Commerce: Overview, Security for E-Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital Certificates, Digital Signatures.

Text Book:

1. Electronic Commerce - Technologies & Applications, Bhaskar Bharat, TMH

Reference Books:

1. E-commerce, MM Oka, EPH
2. Frontiers of Electronics Commerce, Kalakotia, Whinston, Pearson Education
3. Electronic Commerce, Loshinpete, Murphy P. A., Jaico Publishing Housing
4. E-Commerce, Murthy, Himalaya Publishing.

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OPEN ELECTIVE - II

L	T	P	C
3	0	0	3

(R22MED3236) INDUSTRIAL DESIGN & ERGONOMICS

UNIT 1: Introduction: An approach to industrial design -elements of design structure for industrial design in engineering application in modern manufacturing systems. Ergonomics and Industrial Design: Introduction -general approach to the man- machine relationship- workstation design-working position.

UNIT 2: Control and Displays: Shapes and sizes of various controls and displays-multiple, displays and control situations - design of major controls in automobiles, machine tools etc Ergonomics and Production: ergonomics and product design -ergonomics in automated systems- expert systems for ergonomic design. Anthropometric data and its applications in ergonomic, design- limitations of anthropometric data- use of computerized database.

UNIT 3: Visual Effects of Line and Form: The mechanics of seeing- psychology of seeing general influences of line and form. Color: Color and light -color and objects- color and the eye -color consistency-color terms- reactions to color and color continuation -color on engineering equipment.

UNIT 4: Aesthetic Concepts: Concept of unity- concept of order with variety -concept of purpose style and environment- Aesthetic expressions. Style-components of style- house style, observation style in capital goods, case study.

UNIT 5: Industrial Design in Practice: General Design -specifying design equipment- rating the importance of industrial design -industrial design in the design process.

REFERENCE BOOKS:

1. Industrial Design for Engineers - Mayall W.H. - London Hiffee books Ltd.-1988.
2. Applied Ergonomics Hand Book - Brain Shakel (Edited) - Butterworth scientific. London
3. Introduction to Ergonomics - R. C. Bridger - McGraw Hill Publications -1995.
4. Human Factor Engineering - Sanders & McCormick - McGraw Hill Publications – 6th edition,2002.

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OPEN ELECTIVE - II

L	T	P	C
3	0	0	3

(R22HMS3234) CREATIVE WRITING

COURSE OBJECTIVE: This course introduces students to the practice of creative writing in the genres of poetry and fiction. In addition to honing their skills as creative writers, students will develop a critical vocabulary that will aid them in discussing poems and fiction produced by their peers. This course allows for experimentation with writing poetry, short fiction, and creative nonfiction in a writing workshop setting. Far from undertaking the task of making student a professional writer, this class has its goal to familiarize the learner with the dynamics of imaginative literature, the synergy of form and content, and with what makes a particular work effective.

COURSE OBJECTIVES:

1. Discuss with some confidence many of the rhetorical devices, from metaphor to enjambment associated with creative writing.
2. Appreciate the complexity of Poetry, Short Fiction, and Creative Nonfiction.
3. Understand the importance of Creative Writing as a means of self-expression.
4. Read and discuss with enhanced understanding Poetry, Short Fiction, and Creative Nonfiction
5. Show improvement in writing and analytical skills.

UNIT I: Introduction to Literary Forms - Elements of Poetry - Rhythm and Meter Poetic Forms – Ballad, Lyrics, Elegy, Odes, Haiku, Sonnets Literary Genres- Short Fiction, Drama, and Non-Fiction

UNIT II: Poetry Writing - Appreciation of the form and content of poem Techniques - figurative language - (structure - rhythm – imagery – tone – style point of view, voice - read and discuss numerous poems)
Ballad - The Ballad of the Landlord by Langston Hughes; Lyrics - Kubla Khan by Samuel Taylor Coleridge
Elegy - Elegy Written in a Country's Churchyard by Thomas Gray Odes – Ode to a Nightingale by John Keats; Haik u- This Other World by Richard Wright Sonnet - On His Blindness by John Milton Students Creative Assignment – Students will write three poems.

UNIT III: Short Fiction / Novel - Elements of Fiction - Character – Plot- Setting – Theme - Style; Narrator - Point of view - Tone – Suspension of Disbelief. Genres - Adventure, Comic, Fantasy, Gothic, Romance, Historical, Horror, Supernatural, Thriller, Science Fiction - Gooseberries by Anton Chekhov Short Story - My Lost Dollar by Stephen Leacock Students Creative Assignment – Students will write one Short Story

UNIT IV: Drama - Elements of Drama - Character Plot, Theme, Dialogue, Convention, Genre, Audience, Stagecraft, Design, Conversions Drama – The King of the Dark Chamber by Rabindranath Tagore Students Creative Assignment- Students will write a review of the drama read in the class.

UNIT V: Non Fiction - Prose, Biography, Memoirs, and Personal Essays Walden or Life in the Woods by Henry David Thoreau Students Creative Assignment - Students will write one or two essays

REFERENCES

1. Candace H. Schaefer, Rick Diamond. 1998. The Creative Writing Guide: A Path to Poetry, Nonfiction, and Drama, Longman, New York, USA
2. Shelly Clark and Marjone Saisa, 2009. Road Trip: Conversations with Writers, The Backwaters Press, Nebraska, USA
3. Nikki Moustaki (ed.), 1998. Writing Fiction: The Practical Guide from New York's Acclaimed Creative Writing School, Publisher: Bloomsbury, ISBN: 0156005743.

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L	T	P	C
3	0	0	3

(R22HMS3236) DESIGN THINKING

Course Objectives:

- To create awareness of design among students of engineering
- To motivate students to think of design before implementing an engineering project
- To teach a systematic approach to identifying and defining a problem before brainstorming for a solution
- To instill a sense of significance towards applying creativity to product and service design

Course Outcomes: Upon completion of this course, the student shall be

1. Learn to identify design principles from an engineering perspective
2. Cultivate sensitivity towards design aspects in objects made by engineers and non-engineers, which are typically used in daily life
3. Understand and create visual design elements to communicate more effectively
4. Construct clear problem statements, understand the importance of validation, and design services creatively
5. Develop fundamental team skills: working in teams and managing teams, strategizing tasks, and streamlining activities pertaining to a project

Students' Responsibilities:

1. Students will form teams of 3–5 members each, while working collaboratively throughout the semester.
2. Students will present and report the tasks to the class and to the concerned faculty members and design experts, using their oral and written communication skills as well as creativity and team skills.
3. Students must proactively engage in observing the objects and processes which are part of their daily life and society from a design perspective and discuss with peers to learn collaboratively.

UNIT 1: Design Overview and Motivation History and Context of birth of Design; Design thinking: Introduction and Motivation; Various definitions and interpretations of design, Design Vocabulary; Design in Indian Context; Art and Design: Art in Design, Design beyond Art; Design in Creative Industries

UNIT 2: Design Sensitization for Engineers- Design Engineering vs. Engineering Design, Examples of Engineering Design and Design Engineering in various engineering domains, Examples of design failures leading to bad products and services, Real-world examples of bad design that caused engineering and technological disasters, Domain-specific Engineering Design examples

UNIT 3: Design Thinking Foundations The Design Double Diamond: Discover-Define-Develop-Deliver User-centric design approaches: Importance of user-centricity for design, Empathisation, Empathy Maps, Data collection from users and for users, Data Validation Responsible Innovation and Ethical Design: Ethics as foundation for design, Concern for environment and sustainability

UNIT 4: Communication Skills for Design, Culture and Art Communication Media to express an idea: Visuals, Text, Voice and Audio, Info graphics General guidelines for a good Presentation: Target audience, slideshow templates, appropriate visual elements, presentation styles, guidelines General guidelines for a good Report: Documentation classification, standards, styles, and templates Modes of communication: Reports and documents, Presentation, poster, graphic, blog or website. Understanding Art in Design: Need for creativity, Elements of Visual Design Aesthetics: Influences and impressions of Colors, Shapes, Layouts, Patterns, and Fonts as Design Elements

UNIT 5:Applied Creativity and Design for Services Methods to brainstorm solutions for user issues; Combining solutions to workable solution concepts; Identifying the user needs in a service-driven economy; Process Flows and Customer Experience considerations for designing and improving services; 5 Why's; Service Delivery Pathways. Doing Design Looking for a problem, Ideation and Rules of Ideation, Framing and stating the problem; Basic considerations of Prototyping/ Model Building, Basics of Testing and Validation, Incorporating feedback

TEXT BOOKS:

1. Daniel Ling, “Complete Design Thinking Guide for Successful Professionals”, CreateSpace Independent Publishing, 2015 (ISBN: 978-1514202739)
2. Tim Brown, “Change by Design”, Harper Business, 2012 (ISBN: 978-0062337382)
3. Jimmy Jain, “Design Thinking for Startups: A Handbook for Readers and Workbook for Practitioners”, Notion Press, 2018 (ISBN: 978-1642495034)
4. Beverly Rudkin Ingle, “Design Thinking for Entrepreneurs and Small Businesses: Putting the Power of Design to Work”, APress, 2013 (ISBN: 978-1430261810)

REFERENCES:

1. Donald A. Norman, “The Design of Everyday Things”, MIT Press, 2013 (ISBN: 978- 0262525671)
2. Bruno Munari, “Design As Art”, Penguin UK, 2009 (ISBN: 978-0141035819)
3. Tom Kelly, Jonathan Littman, “The Art of Innovation”, HarperCollins Business, 2002 (ISBN: 978-0007102938)
4. Thomas Lockwood, “Design Thinking: Integrating Innovation, Customer Experience, and Brand Value”, Allworth Press, 2009 (ISBN: 978-158115)

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		0	0	6	3
(R22MED4167) PROJECT STAGE - 1					

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L	T	P	C
3	0	0	3

Professional Elective – V

(R22MED4248) ENERGY CONSERVATION AND MANAGEMENT

Objectives: The course is prepared to provide detailed understanding of energy conservation and management, 3Es (Energy, Economics and Environment) and their interaction, energy audit and financial management.

UNIT – I: Energy Scenario:

Classification of Energy, Indian energy scenario, Sectorial energy consumption (domestic, industrial and other sectors), energy needs of growing economy, energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future.

Energy Conservation Act 2001 and related policies: Energy conservation Act 2001 and its features, notifications under the Act, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies, Electricity Act 2003, Integrated energy policy, National action plan on climate change, ECBC code for Building Construction.

UNIT-II: Financial Management, Energy Monitoring and Targeting:

Investment-need, financial analysis techniques simple payback period, return on investment, net present value, internal rate of return, cash flows, risk and sensitivity analysis; financing options, energy performance contracts and role of Energy Service Companies (ESCOs)

Energy Monitoring and Targeting: Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques – energy consumption, production, cumulative sum of differences (CUSUM). Energy Management Information Systems (EMIS)

UNIT-III: Energy Management & Audit:

Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, Benchmarking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering

UNIT-IV: Energy Efficiency in Thermal Utilities and systems:

Boilers: Types, combustion in boilers, performances evaluation, analysis of losses, feed water treatment, blow down, energy conservation opportunities. Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas. Soot blowing and soot deposit reduction, reasons for boiler tube failures, start up, shut down and preservation.

Steam System: Properties of steam, assessment of steam distribution losses, steam leakages, steam trapping, condensate and flash steam recovery system, identifying opportunities for energy savings. Steam utilization, Performance assessment of steam system, thermo-compressor, steam pipe insulation, condensate pumping, steam dryers.

UNIT-V: Energy and environment, air pollution, climate change:

United Nations Framework Convention on Climate Change (UNFCCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), CDM Procedures case of CDM – Bachat Lamp Yojna and industry; Prototype Carbon Fund (PCF).

Reference Books:

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press
2. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press.
3. Bureau of Energy Efficiency Reference book: No.1, 2, 3, 4.
4. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Interscience publication.
5. Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation edited by E J Wilson and D Gerard, Blackwell Publishing.
6. Heating and Cooling of Buildings - Design for Efficiency, J. Krieder and A. Rabl, McGraw Hill Publication, 1994.

Course Outcomes:

- To summarize the energy conservation scenario, energy and environment, air pollution, climate change, and various acts and policy for the energy conservation
- To infer the concept of financial management, energy monitoring and targeting.
- To apply the knowledge of energy audit for the energy management and operation of energy audit instruments.
- To analyze the energy saving area and improvement in efficiency of various thermal utilities and systems.
- To evaluate the net present worth in financial management and performance assessment of various thermal utilities and systems.

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3	0	0	3

Professional Elective – V
(R22MED4241) ADDITIVE MANUFACTURING

Course Objectives:

- To know the principle methods, areas of usage, possibilities and limitations as well as environmental effect of the additive manufacturing technologies.
- To be familiar with the characteristics of the different materials those are used in additive manufacturing.
- Realize the potential implications of AM technologies on product development and identify needs for new technologies to accelerate the advancement and impact of AM.

UNIT I

Introduction to Rapid prototyping, RP Technology Historical Development, Need of Rapid Prototyping, The Basic Design process of Rapid prototyping, Rapid prototyping technology cycle, Principle of rapid prototyping, fundamentals of rapid prototyping systems, challenges associated with rapid prototyping technologies, factors to be considered during development of rapid prototyping.

Advantages of rapid prototyping, limitations of rapid prototyping, materials used in rapid prototyping technology, terms used in rapid prototyping, classification of rapid prototyping systems(RPS), liquid based RPS, solid based RPS, Powder based RPS, Automation of Rapid prototyping, process chain of RP, Rapid tooling, classification, constraints, advantages, Rapid prototyping tooling Vs conventional tooling

Reverse Engineering using RP, process of reverse engineering, future developments of RE, future developments of RP Technology, Difference between Conventional machining and rapid prototyping.

UNIT II**Liquid Based And Solid Based Rapid Prototyping Systems**

Introduction of liquid based and solid based rapid prototyping systems, stereolithography, history of stereolithography, capabilities of SLA, principle of SLA, working process of SLA, specifications of SLA, advantages, disadvantages and applications of SLA. Photopolymers, photo polymerization, advantages of photopolymers, layered manufacturing, issues of layered.

Laser scanning, laser scanning applications, advantages of laser scanning. Introduction to solid ground curing(SGC), working of SGC, principle of SGC, advantages, disadvantages SGC. Introduction to Laminated Object manufacturing(LOM), capabilities of LOM, working process of LOM, advantages, disadvantages of LOM. Introduction Fused deposition modeling, history of FDM, capabilities of FDM, materials of FDM, problem formulation FDM, process parameters, challenges, benefits, disadvantages of FDM, Future of FDM.

UNIT III**Powder Based Rapid Prototyping Systems and Rapid Tooling**

Introduction to powder based RPS, History of SLS, physical phenomena of selective laser sintering (SLS), working of SLS, capabilities of SLS, materials and applications, advantages, disadvantages of SLS. Introduction to 3D Printing, working of 3D printing,

UNIT IV

Rapid Prototyping Data Formats

Introduction to STL file format, History of STL file, STL file uses in other fields, file formats of STL, different types of STL file formats , advantages, disadvantages of STL file, STL file problems, missing facets, degenerate faces, overlapping facet. Non manifold conditions, consequences of building a valid and invalid tessellated model STL file repair, generic solution, other translators, newly proposed formats, magic software, mimics, solid view, view expert, 3D view, 3D doctor.

UNIT V

Rapid Prototyping Applications

Introduction to Rapid Prototyping Applications, RP applications in Design, Heterogeneous object design, RP applications in Automotive Industry, 3D opportunity in the automotive industry, automotive case studies, RP applications in Aerospace industry, features of RP in Aircraft industries, Aerospace Case studies, RP Applications in jewelry and coin industry, RP Applications in GIS, Architectural interior design , art, medical industry. Challenges of rapid prototyping technologies in medicine. Recent and future trends in medical applications, Medical devices, RPA in forensic science, anthropology and visualization of bio molecules.

Testing of 3D printing samples, Introduction, Impact test, tension, compression, hardness test and conclusion, errors in 3D printed parts.

Text Books & References:

1. Ian Gibson, David W Rosen, Brent Stucker., “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010
2. Chua Chee Kai, Leong Kah Fai, “Rapid Prototyping: Principles & Applications”, World Scientific, 2003.
3. Ali K. Kamrani, Emand Abouel Nasr, “Rapid Prototyping: Theory & Practice”, Springer, 2006.
4. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001
5. Andreas Gebhardt, Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Hanser Publishers, 2013.
6. Dr. P. Mallesham, “A Book on Rapid Prototyping”, Research India Publication, 2018

Course Outcomes: Student will be able to:

1. Students can able to complete different methods to discuss the effects of the additive manufacturing technologies
2. Analyse the characteristics of the different materials in additive manufacturing.
3. Select a suitable material for Additive Manufacturing.
4. Analyze different Methods for post-processing of additive manufacturing parts.
5. Understand the applications of Additive Manufacturing
6. Able to know the Testing of 3D printing samples.

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B.Tech. - IV Year – II Semester

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Professional Elective – V (R22MED4242) AUTOMATION IN MANUFACTURING

UNIT – I

Introduction: Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and tool changing and machine tool control transfer the automaton.

UNIT – II

Automated flow lines : Methods of work part transport transfer Mechanical buffer storage control function, design and fabrication consideration.

Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT – III

Assembly system and line balancing : Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT – IV

Automated material handling : Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems.

Automated storage systems, Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT – V

Fundamentals of Industrial controls: Review of control theory, logic controls, sensors and actuators, Data communication and LAN in Manufacturing

Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE.

TEXT BOOK:

1. Automation, Production Systems and Computer Integrated Manufacturing : M.P. Groover 3e./PE/PHI, 2009.

REFERENCES:

1. Computer Aided Manufacturing, Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang, Pearson, 2009.
2. Automation by W. Buekinsham.

Course Outcomes

1. Understand the concept and types of automation
2. Assessment of degree and level of automation, Automated flow lines
3. To know the automation, Assembly system and line balancing
4. Knowledge about various components of automation like sensors, actuators
5. Understanding transfer lines and advanced industrial automation
6. To know Automated material handling and Automated storage systems , Fundamentals of Industrial control

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Professional Elective – V
(R22MED4243) TURBO MACHINERY

Objectives:

1. To learn classification of turbomachines
2. To calculate energy transfer through a turbomachine
3. To understand energy transfer and losses in centrifugal compressors, axial fans and steam turbines

UNIT-I

Introduction to Turbomachines. Classification of Turbomachines. Second Law of Thermo dynamics - turbine/compressor work, Nozzle/diffuser work. Fluid equations - continuity, Euler's, Bernoulli's equation and its applications. Expansion and compression processes, Reheat Factor, Preheat Factor.

UNIT-II

Euler's Equation of Energy Transfer, vane congruent flow, influence of relative circulation, thickness of vanes, number of vanes on velocity triangles, slip factor, Stodola, Stanitz and Balje's slip factor. Suction pressure and net positive suction head. Phenomena of cavitation in pumps. Concept of specific speed, Shape number. Axial, Radial and Mixed Flow Machines. Similarity laws.

UNIT-III

Flow through Axial flow fans. Principles of Axial fan and propeller. Application of fans for air circulation and ventilation. Stage pressure rise and work done. Slip stream and Blade Element theory for propellers. Performance and characteristics of Axial fans.

UNIT-IV

Flow through Centrifugal compressors. Stage velocity triangles, specific work. forward, radial and backward swept vanes. Enthalpy entropy diagram, degree of reaction, slip factor, efficiency. Vane less and vaned diffuser systems, volute as spiral casing. Surge and stall in compressors

UNIT-V

Axial turbine stages, stage velocity triangles, work, efficiency, blade loading, flow coefficient. Single stage impulse and reaction turbines, degree of reaction, 50% reaction turbine stage, Radial equilibrium and Actuator disc approach for design of turbine blades. Partial admission problems in turbines. Losses in turbo machines.

REFERENC BOOKS

1. S.M. Yahya, Turbines, Compressors and Fans, Tata Mcgraw Hill.
2. Gopalakrishnan G, Prithvi Raj D, "A treatise on Turbomachines", Scitec Publications, Chennai, 2002.
3. Sheppard, Principles of Turbomachinery.
4. R.K.Turton, Principles of Turbomachinery, E & F N Spon Publishers, London & New York.
5. Balajee, Designing of Turbomachines.

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Professional Elective – VI
(R22MED4244) FLUID POWER SYSTEM

OBJECTIVES

To familiarize the students with

1. The fundamentals of fluid power
2. Principles and characteristics of the fluid power components
3. Circuit building and interpretation
4. Logic controls and trouble shooting

UNIT I : HYDRAULIC COMPONENTS

Introduction to fluid power system-Pascal's Law-Hydraulic fluids-Hydraulic pumps-Gear, Vane and Piston pumps-Pump Performance-Characteristics and Selection-actuators-valves-pressure control-flow control and direction control valves-Hydraulic accessories-Hydraulic Accumulator.

UNIT II : PNEUMATIC COMPONENTS

Introduction to Pneumatics-Compressors-types-Air treatment-FRL unit-Air dryer-Control valves-Logic valves-Time delay valve and quick exhaust valve-Pneumatic Sensors–types-characteristics and applications.

UNIT III : FLUID POWER CIRCUITS

Circuit Design Methodology-Sequencing circuits-Overlapping signals-Cascade method-KV Map method-Industrial Hydraulic circuits-Double pump circuits-Speed control Circuits-Regenerative circuits-Safety circuits-Synchronizing circuits-Accumulator circuits.

UNIT IV : ELECTRO - PNEUMATICS AND HYDRAULICS

Relay, Switches-Solenoid-Solenoid operated valves-Timer-Counter-Servo and proportional control-Microcontroller and PLC based control-Design of electro-pneumatic and hydraulic circuits.

UNIT V : APPLICATION, MAINTENANCE AND TROUBLE SHOOTING

Development of hydraulic / pneumatic circuits applied to machine tools-Presses-Material handling systems-Automotive systems-Packaging industries-Manufacturing automation-Maintenance and trouble shooting of Fluid Power circuits-Safety aspects involved.

TEXT BOOKS

1. Anthony "Esposito, Fluid Power with applications", Prentice Hall international–1997.
2. Majumdar.S.R, "Oil Hydraulics", Tata McGraw Hill, 2002.
3. Majumdar S.R, "Pneumatic systems-principles and maintenance", Tata McGraw Hill 1995.
4. Werner Deppert, "Kurt Stoll, Pneumatic Application", Vogel verlag–1986.

REFERENCES

1. John Pippenger, Tyler "Hicks, Industrial Hydraulics", McGraw Hill International Edition, 1980.
2. Andrew Parr, "Hydraulics and pneumatics", Jaico Publishing House, 2003.
3. FESTO, "Fundamentals of Pneumatics", Vol I, II, III.

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Professional Elective – VI (R22MED4245) FUZZY LOGIC AND ANN

Course Objectives: After the completion of course the students will

1. Get the exposure to Artificial Neural Networks & Fuzzy Logic.
2. Understand the importance of tolerance of imprecision and uncertainty for design of robust & low cost intelligent machines.

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

1. Identify and describe Fuzzy Logic and Artificial Neural Network techniques in building intelligent machines
2. Apply Artificial Neural Network & Fuzzy Logic models to handle uncertainty and solve engineering problems.
3. Recognize the feasibility of applying a Neuro-Fuzzy model for a particular problem

Unit I: Introduction to Artificial Neural Network

Artificial neural networks and their biological motivation: Terminology, Models of neuron, Topology, characteristics of artificial neural networks, types of activation functions; learning methods: error correction learning, Hebbian learning, Perceptron: XOR Problem, Perception learning rule convergence theorem; Adaline.

Unit II: Feedforward and Recurrent Neural Networks

Architecture: perceptron model, solution, single layer artificial neural network, multilayer. perceptron model; back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications; Recurrent neural networks: Linear auto associator – Bi-directional associative memory – Hopfield neural network.

Unit III: Fuzzy Logic & Fuzzy Sets

Introduction to Fuzzy Logic, Classical and Fuzzy Sets, Membership Function ,Membership Grade, Universe of Discourse, Linguistic Variables, Operations on Fuzzy Sets: Intersections, Unions, Negation, Product, Difference, Properties of Classical set and Fuzzy sets, Fuzzy vs Probability, Fuzzy Arithmetic, Fuzzy Numbers.

Unit IV: Fuzzy Relations & Aggregations

Essential Elements of Fuzzy Systems, Classical Inference Rule, Classical Implications and Fuzzy Implications, Crisp Relation and Fuzzy Relations, Composition of fuzzy relations, Cylindrical Extension and Projection. Fuzzy IF-THEN rules, Inference: Scaling and Clipping Method, Aggregation, Fuzzy rule based Model: Mamdani Model, TSK model, Fuzzy Propositions, Defuzzification: MOM, COA

Unit V: Fuzzy Optimization and Neuro Fuzzy Systems

Fuzzy optimization –one-dimensional optimization. Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks.

Text Books

1. Ross, Timothy J. Fuzzy logic with engineering applications. John Wiley & Sons, 2009.
2. Yegnanarayana, B. Artificial neural networks. PHI Learning Pvt. Ltd., 2004.

Reference Books

1. Zurada, Jacek M. Introduction to artificial neural systems, West St. Paul, 1992.
2. Hagan, Martin T., Howard B. Demuth, and Mark H. Beale. Neural network design. Boston: Pws Pub., 1996.
3. Haykin, Simon. Neural networks: a comprehensive foundation. Prentice Hall PTR, 1994.
4. Passino, Kevin M., and Stephen Yurkovich. Fuzzy control. Vol. 42. Menlo Park, CA: Addison-Wesley, 1998.

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B.Tech. - IV Year – II Semester

L T P C
3 0 0 3

Professional Elective – VI
(R22MED4246) INDUSTRY 4.0

UNIT-I : Introduction to Industry 4.0:

Introduction, core idea of Industry 4.0, origin concept of industry 4.0, Industry 4.0 production system, current state of industry 4.0, Technologies, How is India preparing for Industry 4.0

UNIT-II: A Conceptual Framework for Industry 4.0:

Introduction, Main Concepts and Components of Industry 4.0, State of Art, Supportive Technologies, Proposed Framework for Industry 4.0.

UNIT-III: Technology Roadmap for Industry 4.0 :

Introduction, Proposed Framework for Technology Roadmap, Strategy Phase, Strategy Phase, New Product and Process Development Phase.

UNIT-IV: Advances in Robotics in the Era of Industry 4.0:

Introduction, Recent Technological Components of Robots- Advanced Sensor Technologies, Internet of Robotic Things, Cloud Robotics, and Cognitive Architecture for Cyber-Physical Robotics, Industrial Robotic Applications- Manufacturing, Maintenance and Assembly.

UNIT-V: The Role of Augmented Reality in the Age of Industry 4.0:

Introduction, AR Hardware and Software Technology, Industrial Applications of AR

Obstacles and Framework Conditions for Industry 4.0 : Lack of A Digital Strategy alongside Resource Scarcity, Lack of standards and poor data security, Financing conditions, availability of skilled workers, comprehensive broadband infra- structure, state support, legal framework, protection of corporate data, liability, handling personal data.

Course Outcomes: Students will be able to:

- Describe Industry 4.0 and scope for Indian Industry
- Demonstrate conceptual framework and road map of Industry 4.0
- Describe Robotic technology and Augmented reality for Industry 4.0
- Demonstrate obstacle and framework conditions for Industry 4.0

Reference Books:

1. Alp Ustundag and Emre Cevikcan, "Industry 4.0: Managing the Digital Transformation".
2. Bartodziej, Christoph Jan, "The Concept Industry 4.0".
3. Klaus Schwab, "The Fourth Industrial Revolution".
4. Christian Schröder, "The Challenges of Industry 4.0 for Small and Medium-sized Enterprises".

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3	0	0	3

Professional Elective – VI

(R22MED4247) TOTAL QUALITY MANAGEMENT

COURSE OBJECTIVE: To understand the Engineering and Management aspects of Planning, Designing, Controlling and Improving Quality in Manufactured products.

COURSE OUTCOMES:

1. To understand the fundamentals of quality
2. To understand the role of TQM tools and techniques in elimination of wastages and reduction of defects
3. To develop quality as a passion and habit
4. To understand Quality Improvement Tools and Continuous Improvement
5. To understand Quality Management Systems

UNIT I: Quality Gurus And TQM Kitemarks - Evolution of TQM – Quality Guru’s – Edward Deming – Joseph Juran – Philip Crosby – Genichi Taguchi – Walter Shewart – Criteria for Deming’s Prize
UNIT II - PRODUCT DESIGN AND ANALYSIS (9 hours) Basic Design Concepts and TQM – Design Assurance – Design Validation – Failure Mode Effect Analysis – Fault Tree Analysis – Design for Robustness – Value Analysis

UNIT-III: Process Improvement and Modern Production Management Tools - Six Sigma Approach – Total Productive Maintenance – Just-In-Time – Lean Manufacturing Paradigms

UNIT IV: Quality Improvement Tools and Continuous Improvement - Q-7 Tools – New Q-7 Tools – Quality Function Deployment – Kaizen – 5S – PokaYoke

UNIT V: Quality Management Systems - Quality Management Systems – Introduction to ISO9000 – TS16949:2002 and EMS14001 certifications.

TEXT BOOKS

1. Total Engineering Quality Management, Sunil Sharma, 1st Edition, MacMillan India Limited.
2. Total Quality Management, Poornima M. Charantimath, 2nd Edition, Pearson Education.

REFERENCES

1. “Quality and Performance Excellence”, James R Evans, Edition, 7th Edition, Cengage Learning.
2. “Quality Management”, Howard S Gitlow, Alan J Oppenheim, Rosa Oppenheim, David M Levine, 3rd Edition, Tata McGraw Hill Limited.
3. “Fundamentals of Quality Control & Improvement”, Amitava Mitra, 3rd Edition, Wiley Publications, 2012.

Open Elective –III

S. No.	Course Code	Course Title	L	T	P	Credits
1	R22CIV4233	Remote Sensing Concepts	3	0	0	3
2	R22CSE4233	Fundamentals of Soft Computing				
3	R22ECE4233	Audio & Video Engineering				
4	R22EEE4233	Non Conventional Energy Resources				
5	R22INF4233	Information Security Fundamentals				
6	R22MED4233	Total Engineering Quality Management				
7	R22HMS4233	Human Values & Professional Ethics for Engineers				
8	R22HAS4233	Science Fiction				

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L	T	P	C
3	0	0	3

(R22CIV4233) REMOTE SENSING CONCEPTS

COURSE OBJECTIVES: To introduce the concepts of remote sensing processes and its components. To expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation

COURSEOUTCOMES:

1. At the end of the course the student will be able to understand
2. The characteristics of electromagnetic radiation and its interaction with earth features
3. The types and configuration of various satellites and sensors
4. The elements of data interpretation

UNIT I: Remote Sensing and Electromagnetic Spectrum- Definition – components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum – wave theory, particle theory, Stefan – Boltzmann Law and Wien’s Law – visible and non-visible spectrum – Radiation sources: active & passive; Radiation Quantities

UNIT II: EMR Interaction with Atmosphere- Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere - Scattering (Rayleigh, Mie, non-selective scattering) absorption and refraction – Atmospheric effects on visible, infrared, thermal and microwave spectrum – Atmospheric windows.

UNIT III: EMR Interaction with Earth- Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectro radiometer / Spectrophotometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water body – Factors affecting spectral reflectance of vegetation, soil and water body.

UNIT IV: Platforms and Sensors- Ground based platforms – Airborne platforms – Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Resolution concepts – Scanners - Along and across track scanners – Orbital and sensor characteristics of different satellites – Airborne and Space borne TIR sensors – Calibration – S/N ratio – Passive/Active microwave sensing – Airborne and satellite borne RADAR – SAR – LIDAR , UAV – High Resolution Sensors

UNIT V: Data Products and Visual Interpretation- Photographic (film and paper) and digital products – quick look products - High Resolution data products data - ordering – interpretation – basic characteristics of image elements – interpretation keys (selective and elimination) – visual interpretation of natural resources.

TEXT BOOKS:

1. Richards, Remote sensing digital Image Analysis-An Introduction Springer - Verlag 1993.
2. Lillesand, T.M. and Kiefer R.W. Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York, 2002.

REFERENCES:

1. Janza, F.Z., Blue H.M. and Johnson, J.E. Manual of Remote Sensing. Vol.I, American Society of Photogrametry, Virginia, USA, 2002.
2. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 1995
3. Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 2003.

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OPEN ELECTIVE - III

L	T	P	C
3	0	0	3

(R22CSE4233) FUNDAMENTALS OF SOFT COMPUTING

COURSE OBJECTIVES: The main objective of the Soft Computing Techniques to Improve Data Analysis Solutions is to strengthen the dialogue between the statistics and soft computing research communities in order to cross-pollinate both fields and generate mutual improvement activities.

UNIT I: Introduction: What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.

Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptrons, Back Propagation networks, Architecture of Back propagation(BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.

UNIT II:Fuzzy Systems: Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification.

UNIT III: Genetic Algorithm: History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.

UNIT 4: Hybrid Systems: Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.

UNIT V: GA based Backpropagation Networks:

GA based Weight Determination, K - factor determination in Columns.

Fuzzy Backpropagation Networks: LR type Fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BP, Application of Fuzzy BP Networks

TEXT BOOKS:

1. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.
2. Genetic Algorithms: Search and Optimization, E. Goldberg.
3. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI.
4. Build_Neural_Network_With_MS_Excel_sample by Joe choong.

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OPEN ELECTIVE - III

L	T	P	C
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(R22ECE4233) AUDIO AND VIDEO ENGINEERING

Course Objectives:

- Student are able understand different amplifiers, graphic equalizer and Dolby NR recording systems TV fundamentals like concept of aspect ratio ,image continuity etc Color theory
- Student are able to discuss composite video signal ad CCIR B standard for color signal Transmission and reception, monochrome TV transmitter and receivers, Color TV transmitter and compare TV camera tubes, Color picture tube
- Student are able Illustrate of color TV receivers(PAL-D) and Differentiate between NTSC PAL and SCAM systems cable Television, MATV, CATV, CCTV, Cable TV network and DTH

UNIT I: Hi Fi Audio Amplifier - Introduction to Amplifiers: Mono, Stereo, Public Address; Difference between stereo amplifier and Mono amplifier; Block diagram of Hi Fi amplifier and explanation; Graphic equalizer concept, circuit diagram and operation. (5 Point Circuit diagram); Dolby NR recording system; Types of speaker woofer, Midrange and Tweeter; Cross over network circuit and its function.

UNIT II: TV Fundamentals - Concept of Aspect ratio, image continuity, interlace scanning, scanning periods, horizontal and vertical, vertical resolution, horizontal resolution; Vestigial sideband transmission, bandwidth for Colour signal, picture tube, brightness, contrast, viewing distance luminance, hue, saturation, compatibility; Colour theory, primary colors and secondary colors, additive Colour mixing subtractive Colour mixing; Composite Video Signal, Pedestal height, Blanking pulse, Colour burst, Horizontal sync pulse details, Vertical sync pulse details, Equalizing pulses, CCIR B standards for Colour signal transmission and reception.

UNIT III: TV Transmitters and Receiver - Audio and Video signal transmission; Positive and Negative modulation; Merits and Demerits of Negative modulation; Introduction to television camera tube (a) Vidicon; (b) Plumbicon; (c) Solid State camera based on CCD; Color Picture tube (a) PIL, (b) Delta gun picture tube; Block diagram of monochrome TV transmitter; Block diagram of Colour TV transmitter; Block diagram of monochrome TV Receiver.

UNIT IV: Colour TV - Block Diagram and operation of color TV receiver (PAL D type); Explain – YagiUda Antenna; Explain block diagram of PAL-D decoder with circuit diagram of chroma signal amplifier, Burst pulse blanking, Colour killer control, Basic Circuit for Separation of U and V signals. AGC Amplifier. Colour signal matrixing, RGB drive amplifiers; EHT generation: circuit explanation for line output stage using transistor or IC in Colour TV; Comparisons between NTSC, PAL and SCAM Systems.

UNIT V: Cable Television - Working principle and specification of following components : Dish antenna, LNBC, Multiplexer, Attenuators Connectors (two ways and three ways), Amplifier and cable; MATV,CATV and CCTV;Design concept for cable TV network; Block diagram of dB meter with working principle; Direct to Home System (DTH) Introduction and Block Diagram.

References :

1. Television & Radio Engineering (A.M. Dhake) Tata McGraw Hill.
2. Television Engg and Video System (R.G. Gupta) Tata McGraw Hill.
3. Audio Video Systems (R.G. Gupta) Tata McGraw Hill.
4. Modern TV Praticce (R.R. Gulati) New Age International.
5. Basic Radio and Television (S. Sharma) Tata McGraw Hill.
6. Colour Television Principles and Praticce (R.R. Gulati) New Age International.
7. Basic Television and Video System (Bernard Grob) Tata McGraw Hill.
8. Mono Chrome and Colour Television (R.R. Gulati) New Age International.
9. Modern CD Player Servicing Manual (ManoharLotia) BPB Publication.

Course Outcomes:

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

- C423.1. Explain and differ ate the different amplifiers, graphic equalizer and Dolby NR recording systems (K3-apply)
- C423.2. Describe the TV fundamentals like concept of aspect ratio, image continuity etc Color theory (K2-Understand)
- C423.3. Discuss about composite video signal ad CCIR B standard for color signal Transmission and reception (K2-Understand)
- C423.4. Discuss monochrome TV transmitter and receivers, Color TV transmitter and compare TV camera tubes, Color picture tube (K5-Evaluate)
- C423.5. Diagram Illustrate of color TV receivers (PAL-D) and Differentiate between NTSC PAL and SCAM systems (K4-Analyse)
- C423.6. Explain about cable Television, MATV, CATV, CCTV, Cable TV network and DTH (K2-Understand)

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(R22EEE4233) NON CONVENTIONAL ENERGY RESOURCES

Course Outcomes : This course helps the students to understand the importance, availability, conversion technologies of renewable energy resources and its applications

1. To emphasize the current energy status and role of non-conventional and renewable energy sources.
2. To familiarize various aspects of Solar energy and utilization
3. To familiarize various aspects of Wind energy and utilization
4. To familiarize various aspects of Biomass energy and utilization
5. To emphasize the significance of Green Energy Technologies.

UNIT I: SOLAR ENERGY - Solar radiation its measurements and prediction - Solar thermal collectors - Flat plate collectors, Concentrating collectors – Applications - Heating, Cooling, Desalination, Drying, Cooking, etc - Principle of photovoltaic conversion of solar energy - Types of solar cells and fabrication - Photovoltaic applications - Battery charging, Domestic lighting, Street lighting and water pumping.

UNIT II: WIND ENERGY - Wind energy - Energy chains - Application - Historical background, Merits and limitations - Nature of wind - Planetary and local day / night winds - Wind energy quantum - Power in wind- Turbine efficiency - Torque Thrust calculations Velocity at different heights - Site selection - Components of Wind Energy Conversion System (WECS).

UNIT III: BIOMASS ENERGY - Energy from Biomass - Biomass as Renewable Energy Source - Types of Bio mass Fuels - Solid, Liquid and Gas - Biomass Conversion Techniques- Wet Process, Dry Process- Photosynthesis - Biogas Generation - Factors affecting Biodigestion - Classification of bio gas plant - Continuous, Batch and Fixed Dome types - Advantages and Disadvantages.

UNIT IV: TIDAL, OTEC, HYDEL AND GEOTHERMAL ENERGY - Tidal energy: Tide – Spring tide, Neap tide – Tidal range – Tidal Power – Types of tidal power plant – Single and dual basin schemes – Requirements in tidal power plant - Ocean Thermal Energy Conversion (OTEC): Principle - Open and closed OTEC Cycles - Hydel Energy: Micro hydro - Geothermal Energy: Geothermal energy sources - Power plant and environmental issues.

UNIT V: NEW ENERGY SOURCES - Hydrogen as a renewable energy source - Sources of Hydrogen - Fuel for Vehicles - Hydrogen Production - Direct electrolysis of water, thermal decomposition of water, biological and biochemical methods of hydrogen production - Storage of Hydrogen - Gaseous, Cryogenic and Metal hydride - Fuel Cell – Principle of working, construction and applications.

TEXT BOOKS

1. Rai.G.D, “Non- conventional resources of energy”, Khanna publishers, Fourth edition, 2010.
2. Khan. B.H, “Non-Conventional Energy Resources”, The McGraw Hills, Second edition, 2009.

REFERENCES

1. Rao.S&Parulekar, “Energy Technology”, Khanna publishers, Fourth edition, 2005.
2. Pai.B.R and Ram Prasad.M.S, “Power Generation through Renewable Sources of Energy”, Tata McGraw Hill, New Delhi, 1991.
3. Bansal.N.K, Kleeman and Meliss, “Renewable energy sources and conversion Techniques”,Tata McGraw hill, 1990.
4. Godfrey Boyl “Renewable Energy: Power Sustainable Future”,Oxford University Press, Second edition, 2006.
5. Ryan O’Hayre, Suk-Won Cha and Whitney colella, “Fuel Cell Fundamentals”, Second edition, 2009.
6. John W Twidell and Anthony D Weir, “Renewable Energy Resources”, Taylor and Francis, 2006.
7. Freris.L.L, “Wind Energy Conversion systems”, Prentice Hall, UK, 1990.

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OPEN ELECTIVE - III

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(R22INF4233) INFORMATION SECURITY FUNDAMENTALS

COURSE OBJECTIVES:

1. To provide impeccable knowledge on various technical aspects of Information Security & Computer Security principles
2. To provide foundation for understanding the key issues associated with protecting Computer Systems & Information Assets.
3. To provide competency in designing consistent & reasonable Information security system with appropriate Scanning & Enumeration mechanisms, determining the level of protection and Response to security incidents.

UNIT I: Introduction to Information Security - Introduction to Information Security, Need for Security - Threats to security & Attacks, Computer System Security and Access Controls - System access and data access.

UNIT II: Communication Security - Introduction to cryptography, cryptosystems, Encryption & Decryption Techniques - classical encryption techniques, communication channel used in cryptographic system, various types of ciphers, Cryptanalysis, Hash function and Data integrity, Security of Hashing function.

UNIT III: Network - Introduction to Network Security, Email Security, IP Security, Web Security, Kerberos, X.509 techniques.

UNIT IV: Scanning & Enumeration Technology - Malicious software, Firewalls, Honey pots, Intrusion Detection system, Intrusion Prevention system

UNIT V: Ethics In Information Security - Implementing Information Security, Legal Ethical & Professional issues in Information Security.

TEXT BOOKS:

1. Matt Bishop, "Computer Security: Art and Science", Addison-Wesley Professional, First Edition, 2003. ISBN: 0201440997.
2. William Stallings, "Cryptography and Network Security", Pearson Education, Fourth Edition, 2006. ISBN: 8177587749

REFERENCES:

1. Michael E. Whitman, Herbert J. Mattord, "Principles of Information Security" Cengage Learning, Fourth Edition, 2010, ISBN: 1111138214
2. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network security: private communication in a public world", Second Edition, ISBN: 0130460192.
3. Dieter Gollmann, "Computer Security", Third Edition, ISBN: 0470741155.

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY
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B.Tech. - IV Year – II Semester

OPEN ELECTIVE - III

L	T	P	C
3	0	0	3

(R22MED4233) TOTAL ENGINEERING QUALITY MANAGEMENT

COURSE OBJECTIVE: To understand the Engineering and Management aspects of Planning, Designing, Controlling and Improving Quality in Manufactured products.

COURSE OUTCOMES:

1. To understand the fundamentals of quality
2. To understand the role of TQM tools and techniques in elimination of wastages and reduction of defects
3. To develop quality as a passion and habit

UNIT I: Quality Gurus And TQM Kitemarks - Evolution of TQM – Quality Guru’s – Edward Deming – Joseph Juran – Philip Crosby – Genichi Taguchi – Walter Shewart – Criteria for Deming’s Prize
UNIT II - PRODUCT DESIGN AND ANALYSIS (9 hours) Basic Design Concepts and TQM – Design Assurance – Design Validation – Failure Mode Effect Analysis – Fault Tree Analysis – Design for Robustness – Value Analysis

UNIT-III: Process Improvement and Modern Production Management Tools - Six Sigma Approach – Total Productive Maintenance – Just-In-Time – Lean Manufacturing Paradigms

UNIT IV: Quality Improvement Tools and Continuous Improvement - Q-7 Tools – New Q-7 Tools – Quality Function Deployment – Kaizen – 5S – PokaYoke

UNIT V: Quality Management Systems - Quality Management Systems – Introduction to ISO9000 – TS16949:2002 and EMS14001 certifications.

TEXT BOOKS

3. Total Engineering Quality Management, Sunil Sharma, 1st Edition, MacMillan India Limited.
4. Total Quality Management, Poornima M. Charantimath, 2nd Edition, Pearson Education.

REFERENCES

4. “Quality and Performance Excellence”, James R Evans, Edition, 7th Edition, Cengage Learning.
5. “Quality Management”, Howard S Gitlow, Alan J Oppenheim, Rosa Oppenheim, David M Levine, 3rd Edition, Tata McGraw Hill Limited.
6. “Fundamentals of Quality Control & Improvement”, Amitava Mitra, 3rd Edition, Wiley Publications, 2012.

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY**(An Autonomous Institution under UGC, New Delhi)****B.Tech. - IV Year – II Semester****OPEN ELECTIVE - III**

L	T	P	C
3	0	0	3

(R22HMS4233) HUMAN VALUES & PROFESSIONAL ETHICS FOR ENGINEERS**Course Objectives:**

1. To know the different moral and ethical issues through various prominent theories.
2. To educate the code of ethics as well as the industrial standards and how they can be used for ensuring safety and reducing the risk.
3. To vocalize the Rights and Responsibilities of individuals.
4. To enable the students to imbibe and internalize the Values and Ethical Behavior in the personal and Professional lives.

Course Outcome: The students will understand the importance of Values and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen.

UNIT – I Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT – II Basic Theories: Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

UNIT – III Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession. Central Responsibilities of Engineers – The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

UNIT – IV Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation. Ethics in changing domains of research – The US government wide definition of research misconduct, research misconduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.

UNIT – V Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights.

TEXT BOOKS:

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

REFERENCES

1. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e ,Cengage learning, 2015.
2. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY**(An Autonomous Institution under UGC, New Delhi)****B.Tech. - IV Year – II Semester****OPEN ELECTIVE - III****L T P C****3 0 0 3****(R22HAS4233) SCIENCE FICTION**

COURSE OBJECTIVES: To help learners understand the link between Science and Technology and Humanities, especially Fiction form in Literature, with a view to instilling in them a sensitivity to the current issues of the world and probable issues that will crop up in the future world and imbibe in them a fine sensibility to appreciate and handle with balance the borderline problems of interdisciplinary nature with integrity and responsibility.

COURSE OUTCOMES:

1. To enable the learners to appreciate the literary form of Science Fiction
2. To give them a firsthand linguistic experience of the various types of Science Fiction novels
3. To equip the learners with the discretion to distinguish between a successful/effective science fiction novel and the one not so
4. To enhance the learners' communication skills and to develop their potential for creative writing
5. To spark off the dormant researcher in the learner so that he/she will use it for the betterment of the world

UNIT I: Science Fiction – an Introduction - 1. What is science fiction? Characteristics. 2. Classification 3. Types 4. A Historical Overview

UNIT II: Novels of other Worlds - 1. Utopian Science Fiction Novels Huxley, Aldous. Island.1932; Harper Perennial Classics, 2002. 2. Dystopian Science Fiction Novels Huxley, Aldous. Brave New World.Chatto and Windus, 1962.

UNIT III: Novels of other Beings - 1. Robots and Science Fiction Asimov, Isaac.I Robot.Granada, 1950. 2. Aliens and Science Fiction Card, Orson Scott. Ender's Game. Starscape, 2002.

UNIT IV: Novels of Time Travel -1. Travel into future a. H. G. Well's Time Machine. 2. Travel into past a. Asimov, Isaac and Robert Silverberg. Child of Time.Tor, 1993.

UNIT V : Novels on Women's Issues - 1. Man Controlling Women a. Shelley, Mary. Frankenstein.1818; Barnes and Noble, 2009. 2. Varied Identities of Women b. RUSS, JOANNA. THE FEMALE MAN. BEACON PRESS, 2000

REFERENCES

1. Seed, David. "Science Fiction: A Very Short Introduction". OUP, 2011.
2. Roberts, Adam. "Science Fiction". 2 revised. Routledge, 2005.
3. Moylan, Tom and RaffaellaBaccolini. "Dark Horizons: Science Fiction and the Dystopian Imagination". Routledge, 2003.
4. Little, Judith.A. "Feminist philosophy and science fiction: utopias and dystopias", Prometheus Press, 2007.
5. Atwood, Margaret. "In Other Worlds".Anchor, 2012.
6. Reid, Robin.A. "Women in Science Fiction and Fantasy".Greenwood Press, 2009. 7. Schneider, Susan. "Science Fiction and Philosophy: From Time Travel to Superintelligence", Wiley Blackwell, 2009.
7. Drout, Michael D.C. From "Here to Infinity: An Exploration of Science Fiction Literature",. 7 CDs. Published in 2006 by Recorded Books.
8. Melzer, Patricia. "Alien Constructions: Science Fiction and Feminist Thought", University of Texas Press, 2006.

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B.Tech. - IV Year – II Semester		L	T	P	C
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(R22MED4264) PROJECT STAGE – II INCLUDING SEMINAR					