

COLLEGE VISION

To educate and enrich effective and responsible mechanical engineers to fulfill the needs of industry and society.

COLLEGE MISSION

- To lay a strong foundation of technical knowledge by concentrating on fundamental concepts of Mechanical engineering.
- To develop creative thinking and innovative methods to solve complex problems
- To develop team spirit, leadership and professional qualities
- To provide research facilities for students to create opportunities
- To strengthen and expand collaboration and partnership with industry and other organizations

PROGRAM EDUCATIONAL OBJECTIVES :

PEO1:

To prepare graduates with a solid foundation in engineering, Science and Technology for a successful career in Mechanical Engineering

PEO2:

To prepare graduates to become effective collaborators / innovators in efforts to address social, technical and engineering challenges

PEO3:

To prepare graduates to get employment in industries or pursue higher studies or research assignments or turn as entrepreneurs.

PEO4:

To prepare graduates to inculcate good communication skills, leadership skills, professional, ethical and social responsibilities.

PROGRAM OUTCOMES (POs):

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

1. Student able to model, analyze and simulate the mechanical design physical systems, components or processes.
2. Students shall have additional skills and knowledge to develop and implement thermal engineering systems.

INTRODUCTION

Academic Programmes of the institute are governed by rules and regulations approved by the Academic Council, which is the highest Academic body of the Institute. These academic rules and regulations are applicable to the students admitted during the academic year 2014-15 into first year of four year undergraduate programme offered by the college leading to Bachelor of Technology (B.Tech) degree in the disciplines viz., Computer Science and Engineering, Electronics and Communication Engineering, Electrical and Electronics Engineering, Information Technology, Mechanical Engineering & Civil Engineering.

EXTENT: All the rules and regulations, specified herein after will be read as a whole for the purpose of interpretation and when a doubt arises, the interpretation of the Chairman, Academic Council, Swarnandhra College of Engineering & Technology (Autonomous) is the final. As per the requirements of the Statutory Bodies, Principal, Swarnandhra College of Engineering & Technology (Autonomous), will be the Chairman of the College Academic Council.

1. ADMISSIONS:

1.1. Admission into first year of any Four Year B.Tech Programmes of study in Engineering:

Admissions into first year of B.Tech Programme of Swarnandhra College of Engineering & Technology (Subsequently referred to as SCET) will be as per the norms stipulated by Jawaharlal Nehru Technological University Kakinada & Govt. of Andhra Pradesh. Admissions in each programme in the Institution are classified into CATEGORY - A (70% of intake) through convener, EAMCET and CATEGORY- B (30% of intake) filled by the college management.

1.2. Admission into the Second year (Lateral Entry) of any Four year B.Tech Programme of study in Engineering: The candidates should have passed the qualifying exam. (B.Sc. graduation & Diploma holders) for admission into the 3rd semester directly, based on the rank secured by the candidate at Engineering Common Entrance Test [ECET for (FDH)] in accordance with the instructions received from the Convener, ECET and Government of Andhra Pradesh.

The candidate has to satisfy the other eligibility requirements stipulated by the JNT University Kakinada and / or the Government of Andhra Pradesh from time to time.

1.3. Admissions with advance standing: These may arise in the following cases:

- a) When a student seeks transfer from other colleges to SCET and disireous to pursue the study at SCET in an eligible branch of study.
- b) When students of SCET get transferred from one regulation to another regulation or from previous syllabus to revised syllabus.
- c) When a student after long discontinuity rejoins the college to complete his/her Programme of study for the award of degree.
- d) When a student is not able to pursue his/her existing Programme of study but wishes to get transferred to another Programme of study.

These admissions may be permitted by the Academic Council of SCET as per the norms stipulated by the statutory bodies and Govt. of Andhra Pradesh. In all such cases for admission, when needed, permissions from the statutory bodies are to be obtained and the Programme of study at SCET will be governed by the transitory regulations.

2. PROGRAMMES OFFERED (UNDER GRADUATE)

Presently, the college is offering Under Graduate Programmes in the following disciplines:

- Computer Science and Engineering (CSE)
- Electronics and communication Engineering(ECE)
- Electrical and Electronics Engineering(EEE)
- Information Technology (IT)
- Mechanical Engineering(ME)
- Civil Engineering (CE)

3.1 Structure of the Programme:

Each Programme of a Discipline or branch of study will consist of:

- (i) General core courses in Basic Sciences, Engineering & Technology, Humanities, Mathematics and Management.
- (ii) Interdisciplinary courses in Engineering, to impart the fundamentals of Engineering.
- (iii) Compulsory core courses to impart broad based knowledge needed in the concerned branch of study.
- (iv) Elective courses from either the discipline or interdisciplinary areas / industry related opted by the student based on his/her interest in specialization.
- (v) Seminars, Technical Paper, Comprehensive Viva-Voce, Mini Project and Major Project approved by the Department to be submitted in the course of study.

Each Programme of study will be designed to have 40-45 theory courses and 16-18 laboratory courses. The distribution and types of courses offered from the above is indicated in the following table.

General Core courses	25-30%
Interdisciplinary courses in engineering	15-20%
Compulsory Core courses in the branch of study	45-50%
Elective Courses	5-10%

Note: All components prescribed in the curriculum of any Programme of study will be conducted and evaluated.

Contact hours: Depending on the complexity and volume of the course the number of contact hours per week will be determined (4 to 6 hours per week per course).

Credits: Credits are assigned to each course as per norms mentioned in the following table.

Subject	Credits
Theory Course	03
Laboratory Course	02
Seminar/ Technical Paper	02
Soft Skills / Aptitude Lab	01
Comprehensive Viva	02
Mini Project	02
Major Project	06

3.2 Curriculum for each Programme of study:

- The Four year curriculum of any B.Tech Programme of study in any branch of Engineering is formulated based on the guidelines mentioned in 3.1 and will be recommended by the concerned Board of Studies and is approved by the Academic council of the college.
- In case of students admitted under lateral entry, the respective regular curriculum contents from 3rd semester onwards are to be pursued by them.
- In case of students admitted under advanced standing, the Programme of curriculum will be prepared by the concerned Board of Studies and the Academic Council has to approve the same.
- After approval from the Academic Council, Programme of curriculum for the same will be prepared and made available to all the students along with the academic regulations.

3.3 Maximum duration of study and cancellation of admission:

Maximum duration permitted for any student to successfully complete the four year B.Tech. Programme of study will be:

- Eight academic years in sequence from the year of admission for a normal student admitted into first year of any Programme.
- Six academic years in sequence from the year of admission for a Lateral entry student admitted into second year of any Programme.
- For students admitted with advanced standing, the maximum time for completion of Programme of study, will be twice the period in terms of academic years in sequence, stipulated in the Programme curriculum defined at the time of admission.

In case, any student fails to meet the above applicable/eligible conditions for the award of degree, his/her admission stands cancelled.

4. **DURATION OF THE PROGRAMME AND MEDIUM OF INSTRUCTION:** The duration of the B.Tech. Programme is four academic years consisting of eight semesters. The medium of instruction and examinations is in English. Students, who fail to fulfill all the academic requirements for the award of the degree within minimum of eight academic years, will forfeit their admission in B.Tech course.

5. **MINIMUM INSTRUCTION DAYS:** Each semester will consist of 22 weeks duration with minimum of 110 working days which includes instruction, Mid examinations and Final examinations. The no. of contact periods per week are 42 to 48.

6. **TRANSITORY REGULATIONS:**

For students admitted under advance standing, these transitory regulations will provide the modus operandi. At the time of such admission, based on the Programme pursued (case by case) Equivalent courses completed by the student are established by the BOS of concerned discipline. Marks/Credits are transferred for all such equivalent courses and treated as successfully completed in the Programme of study prescribed by SCET.

A Programme chart of residual courses not completed will be derived and a Programme of study with duration specified will be prescribed for pursuit at SCET.

Marks obtained in the previous system, as the case maybe, are converted to grades and CGPA is calculated.

All other modalities and regulations governing will be the same as those applicable to the stream of students with whom, such a candidate is merged with current regulations.

7. DISTRIBUTION AND WEIGHTAGE OF MARKS:

- (i) In each semester the course of study consists of 5/6 theory subjects + 2/3 laboratories. However, in the 8th semester there will be only 3 theory subjects in addition to the major project work and comprehensive viva-voce.
- (ii) The performance of a student in each semester will be evaluated subject wise with a maximum of 100 marks for theory and 75 marks for practical subject. In addition Seminars, Technical Paper and Mini Project are also evaluated. Mini Project, Technical paper and Seminar are for 50 marks. Main Project during 8th Semester is for 200 marks.
- (iii) Seminar/Technical Paper: The Seminar/Technical paper has two components of study one from the topics of current study (course work) and the other component is suggested by the staff advisor, like reproduction of the concept in any standard research paper or an extension of concept from earlier course work. A hard copy of the information on Seminar/Technical paper topic in the form of a report is to be submitted for evaluation along with presentation. The two components of the Seminar/Technical paper are evaluated for 50 marks each. in the semester. The average of the two components shall be taken as the final score. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits.

- (iv) **Mini Project:** The mini project shall be carried out during the summer vacation for a minimum of 4 weeks after the 6th semester and is to be completed before the start of the 7th Semester. A report has to be submitted at the beginning of the 7th semester for assessment by an internal evaluation committee comprising Head of the Department and two faculty of the department including the project Supervisor for 50 Marks. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits.
- (v) For each theory subject the distribution will be 30 marks for internal evaluation and 70 marks for the end semester examination. The internal evaluation of 30 marks consists of descriptive test for 20 marks and objective test for 10 marks.
- (vi) As part of internal assessment for each theory subject there will be 3 cycles of examinations. Each cycle consists of one descriptive test and one objective test which will be conducted after completion of two units of syllabus. Weighted average of three cycle's performance will be considered for award of internal assessment. A weight age of 50% for the first best cycle performance, 35% for second best cycle performance and remaining 15% for the third cycle performance are given for internal evaluation.
- (vii) The descriptive examination consists of 4 questions and three questions need to be answered in 90 minutes. The objective examination consists of 20 multiple choice questions and all are to be answered in 20 min of duration.
- (viii) The end semester examination will be conducted for 70 marks covering the total syllabus of concerned subjects. In end semester examination pattern, Part – A consists of a compulsory question from all units (Brainstorming/Thought provoking/Case study) for 22 marks. Part – B has 6 questions (one question from each unit) of which three questions are to be answered and valued for 48 marks.
- (ix) End practical examination will be conducted for 50 marks by the teacher concerned and external examiner. For practical subjects there will be continuous assessment during the semester for 25 internal marks with 15 marks for day-to-day work, including record valuation and 10 marks for two internal tests (80% for first best, 20% for second).

- (x) For the subjects of design and / or drawing (such as Engineering Drawing, Machine Drawing etc.) and estimation, the distribution will be for 30 marks as internal evaluation with 10 marks for day-to-day work, 20 marks for three Internal tests (50% for first best, 35% for second best and 15% for third). End examination will be conducted for 70 marks.
- (xi) Main Project: The project work to be carried out by the students during 8 semester is evaluated for Internal assessment and External Examination.
- a) Internal Assessment: Internal Assessment will be carried out by Project internal assessment committee consisting of 1) Head of the Department 2) Supervisor and 3) Senior faculty member appointed by the Principal.
- b) External Examination: External Examination will be conducted by Project external examination committee consisting of 1) Head of the Department 2) Supervisor and 3) External Examiner selected from the panel of Examiners.
- (xii) Total marks awarded for Project work is 200, of which 60 marks are for Internal Evaluation and 140 marks for External examination through presentation / viva - voice by / of each student. The internal evaluation will be on the basis of two seminars on the topic of the project.
- (xiii) The comprehensive viva, evaluated for 50 marks during 8th Semester. The comprehensive viva will be conducted/ evaluated on the topics covering the core aspects of the subjects in which the candidate is likely to be graduated.

8. ATTENDANCE REGULATIONS AND CONDONATION:

- (i) A student will be eligible to appear for end semester examinations, if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects.
- (ii) Condonation for shortage of attendance in aggregate, up to 10% on medical grounds (Above 65% and below 75%) in any semester may be granted by the College Academic Committee. However, the subject of granting condonation is totally at the discretion of the College Academic Committee (CAC).

- (iii) The student will not be promoted to the next semester unless he/she satisfies the attendance requirements of the present semester as applicable. They may seek re-admission for that semester, as and when offered next by the Department.
- (iv) Shortage of Attendance below 65% in aggregate in no case be condoned
- (v) Students with less than 65% of attendance in any semester are not eligible to take up the end examination of that particular semester and their registration for examination will be cancelled.
- (vi) A stipulated fee to be paid by the student towards condonation of attendance.
- (vii) Attendance may also be condoned for those who participate in Intercollegiate/university sports, co- and extracurricular activities provided their attendance is in the minimum prescribed range for the purpose (>65% and <75%) and recommended by the concerned authority and condonation fees is to be paid.
- (viii) A student will be condoned only twice during his entire course of study.

9. MINIMUM ACADEMIC REQUIREMENTS:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in S.No.8.

- (i) A student will be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or practical or design or drawing subject or project if he/she secures not less than a minimum of 35% of marks exclusively in the end semester examinations in each of the subjects, for which the candidate had appeared. However, the candidate should have secured a minimum of 40% marks in both external and internal components put together to declare eligible for pass in the subject.
- (ii) A student will be promoted from first sem to second sem , second sem to third and third to fourth sem, if he/she satisfies the minimum attendance requirement.
- (iii) A student will be promoted from 4th Semester to 5th Semester, if he/she fulfills the academic requirements of 40% of the credits up to 4th Semester from all the examinations (Regular and Supplementary) whether or not the candidate takes the examinations.

A student will be promoted from 6th to 7th Semester, only if he/she fulfills the academic requirements of 40% of the credits up to 6th Semester from, all the examinations (Regular and Supply) whether or not the candidate takes the examinations.

- (v) There will be Supplementary examinations along with the Regular semester examinations enabling the students to give a fair chance to appear in the subject if any failed.
- (vi) Student who fails in 8th Semester can re-appear for Advanced Supplementary Examinations soon after the announcement of result.

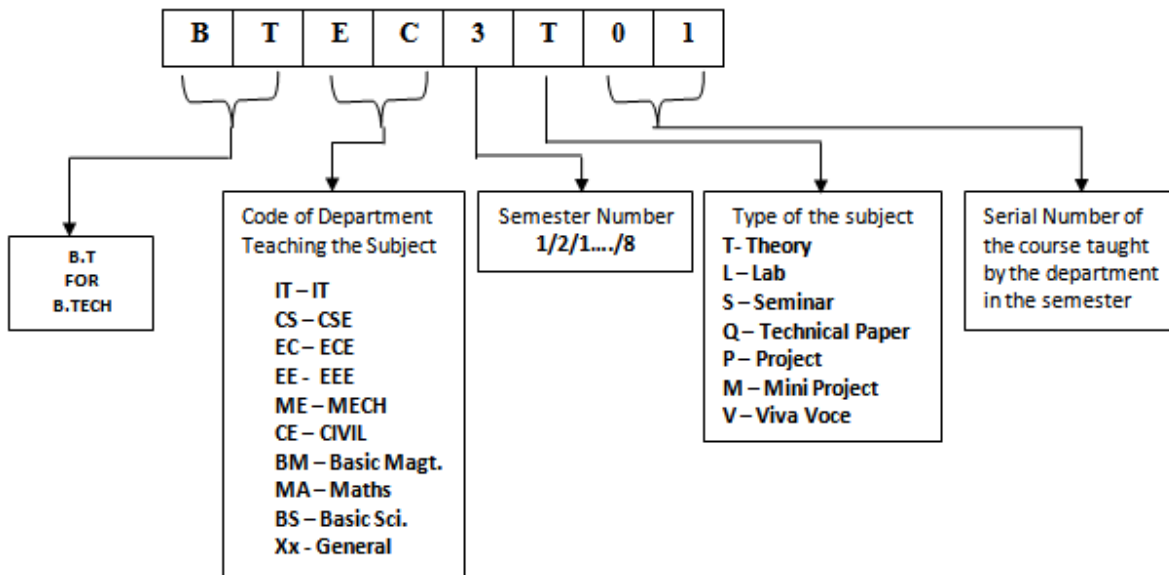
10. ELIGIBILITY FOR AWARD OF DEGREE:

A student shall be eligible for award of the B.Tech. Degree if he/she fulfills all the following conditions:

- (i) Pursued a course of study for a stipulated period of four years and not more than eight years from the year of admission.
- (ii) Registered and successfully completed all the components prescribed in the programme of study to which he/she is admitted.
- (iii) Obtained CGPA greater than or equal to 5 (minimum requirements for pass).
- (iv) Has no dues to the institute, hostels, libraries, NCC/NSS etc., and No disciplinary action is pending against him/her

11. COURSE CODE & COURSE NUMBERING SCHEME:

The subject codes will be given by the department teaching the subject. Each subject code contains 8 characters. The 8 characters for each subject will be filled as per the following guidelines.



12. GRADING SYSTEM:

12.1 Award of Grade:

(i) Grade Point Average (GPA):

a) The Grade Point Average (GPA) will be calculated according

to the formula.
$$GPA = \frac{\sum C_i G_i}{\sum C_i} \text{ --- (1)}$$

Where C_i = number of credits for the subject i

G_i = grade points obtained by the student in the subject.

b) Semester Grade Point Average (SGPA) is awarded to candidates considering all the subjects of the semester. Zero grade points are also included in this computation.

c) To arrive at Cumulative Grade Point Average (CGPA), the formula (2) is used considering the student’s performance in all the courses taken in all the semesters completed up to the particular point of time.

$$CGPA = \sum C_i G_i / C_i \text{ --- (2)}$$

Where C_i = number of credits for the subject i

G_i = grade points obtained by the student in the subject.

(ii) After a student satisfies the requirements prescribed for the award of UG/PG Program he/she shall be placed in one of the following four grades. The award of the degree is based on CGPA on a grade point scale of 10.

CGPA	Award of Division
≥8.00*	First Class with Distinction
≥7.00	First Division
≥6.00	Second Division
≥5.00	Pass Division
<5.00	Unsatisfactory

*In addition to the required CGPA of 8, the student must have necessarily passed all the courses of every semester in the minimum stipulated period for the programme.

12.2 Award of Grade in Each Semester:

- (i) Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester for each subject. The letter grades and the corresponding grade points are as given in the Table.

PERCENTAGE OF MARKS SCORED	PERCENTAGE OF MARKS SCORED	GRADE POINTS
>=90	S	10
80 – 89	A	9
70-79	B	8
60-69	C	7
50-59	D	6
40-49	E	5
<40	F	FAIL

- (ii) A student earns a minimum of 5 grade points (E grade) in a subject is declared to have successfully completed the subject, and is deemed to have earned the credits assigned to that subject. However it should be noted that a pass in any subject/term paper/seminar/project/mini project shall be governed by the rules mentioned in S.No.7.
- (iii) Grade Sheet: A grade sheet (memorandum) will be issued to each student indicating his/her performance in all courses taken in that semester and also indicating the grades and SGPA.
- (iv) Transcripts: After successful completion of the total programme of study, a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued up to any point of study to any student on request and by paying the stipulated fee in force.

- (v) Candidates shall be permitted to apply for recounting/revaluation within the stipulated period with payment of prescribed fee.
- (vi) The Academic Council has to approve and recommend to the JNTUK, Kakinada for the award of a degree to any student.

13. **SUPPLEMENTARY EXAMINATIONS:** In addition to the Regular Final Examinations held at the end of each semester, Supplementary Final Examinations will be conducted during the academic year. A student can appear for any number of supplementary examinations till he/she clears all courses which he/she could not clear in the first attempt. However the maximum stipulated period cannot be relaxed under any circumstance.

14. **ADVANCED SUPPLEMENTARY EXAMINATIONS:** Candidate who fails in the subjects of 8th Semester can appear for Advanced Supplementary Examinations soon after the announcement of result..

15. **ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME):**

- (i) The students have to acquire 132 credits from 3 Semester to 8 Semester of B.Tech Programme (regular) for the award of the degree.
- (ii) Students, who fails to fulfill the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seat.
- (iii) The same attendance regulations are to be adopted as per the rules mentioned in item No.8.
- (iv) Rules for Promotion in to Next Higher Class: (6th Semester to 7th Semester): A student shall be promoted from 6th Semester to 7th Semester only if he/she fulfills the academic requirements of 40% credits up to 6th Semester.

16. **CONDUCT AND DISCIPLINE:**

- (a) Students shall conduct themselves within and outside the premises of the institute in a manner befitting to be the student of our institution.
- (b) As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is strictly banned. Any form of ragging will be severely dealt with.

- (c) The following acts of omission and/or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.
- (i) Lack of courtesy and decorum inducement behavior anywhere within or outside the campus.
 - (ii) Willful damage or distribution of alcoholic drinks or any kind of narcotics or of fellow students/citizens.
- (d) Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.
- (e) Mutilation or unauthorized possession of library books.
- (f) Noisy and unseemly behavior, disturbing studies of fellow students.
- (g) Hacking in computer systems (such as entering into other person's areas without prior permission, manipulation and/or damage of computer hardware and software or any other cybercrime etc).
- (h) Usage of cells phones and cameras in the class room/campus.
- (i) Plagiarism of any nature in any academic report of submission.
- (j) Any other act of gross indiscipline as decided by the academic council from time to time.
- (k) Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute / hostel, debarment from examination, disallowing the use of certain facilities of the institute, suspension for a specified period or even outright expulsion from the institute, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.
- (l) For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief Warden, the Head of the Department and the principal respectively, shall have the authority to reprimand or impose fine.
- (m) Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the principal for taking appropriate action.
- (n) All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the Academic council.

- (o) The Institute Level Standing Disciplinary Action Committee constituted by the academic council, shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.
- (p) The Principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the Programmes Committee in an appropriate manner, and subsequently such action shall be placed before the academic council for ratification, Any emergency modification of regulation, approved by the academic council earlier, shall be reported to the academic council for ratification.
- (q) “Grievance and Redressal Committee” (General) constituted by the principal shall deal with all grievances pertaining to the academic / administrative/disciplinary matters.
- (r) All the students must abide by the code and conduct rules of the college.

17. **MALPRACTICES:** The Principal shall refer the cases of malpractices in internal assessment tests and Semester-End Examinations, to a Malpractice Enquiry Committee, constituted by him/her for the purpose. The principal will take necessary action, against the erring students basing on the recommendations of the committee and shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the Heads of the Departments in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved in the Heads of the Departments meetings, shall be reported to the academic council for ratification.

18. AMENDMENTS TO REGULATIONS:

The Academic Council of Swarnandhra College of Engineering & Technology (Autonomous) reserves the right to revise, amend or change the Regulations, Schemes of Examinations, and/or Syllabi or any other matter pertained suitable to the needs of the students, society, industry without any notice.

MECHANICAL ENGINEERING DEPARTMENT**B.TECH COURSE STRUCTURE****I SEMESTER**

S NO	COURSE CODE	COURSE NAME	L	T	P	C	I	E	TM
1	BTBS1T01	ENGLISH – I	3	1	--	3	30	70	100
2	BTMA1T01	DIFFERENTIAL EQUATIONS	3	1	--	3	30	70	100
3	BTEE1T01	BASIC ELECTRICAL AND ELECTRONICS	3	1	--	3	30	70	100
4	BTBS1T03	ENGINEERING PHYSICS	3	1	--	3	30	70	100
5	BTME1T01	ENGINEERING DRAWING	1	--	3	3	30	70	100
6	BTCS1T01	C.PROGRAMMING	3	1	--	3	30	70	100
7	BTBS1L01	ENGLISH COMMUNICATION SKILLS LAB-I	--	--	3	2	25	50	75
8	BTBS1L03	ENGINEERING PHYSICS LAB	--	--	3	2	25	50	75
9	BTCS1L01	C.PROGRAMMING LAB	--	--	3	2	25	50	75
TOTAL			16	05	12	24	255	570	825

II SEMESTER

S NO	COURSE CODE	COURSE NAME	L	T	P	C	I	E	TM
1	BTBS2T01	ENGLISH – II	3	1	--	3	30	70	100
2	BTMA2T01	LINEAR ALGEBRA & VECTOR CALCULUS	3	1	--	3	30	70	100
3	BTMA2T02	NUMERICAL METHODS AND INTEGRAL TRANSFORMS	3	1	--	3	30	70	100
4	BTBS2T02	ENGINEERING CHEMISTRY	3	1	--	3	30	70	100
5	BTBS2T04	ENVIRONMENTAL STUDIES	3	1	--	3	30	70	100
6	BTME2T02	ENGINEERING MECHANICS	3	1	--	3	30	70	100
7	BTBS2L01	ENGLISH COMMUNICATION SKILLS LAB - II	--	--	3	2	25	50	75
8	BTBS2L02	ENGINEERING CHEMISTRY LAB	--	--	3	2	25	50	75
9	BTME2L01	ENGINEERING WORKSHIOP	--	--	3	2	25	50	75
TOTAL			18	06	09	24	255	570	825

**L-LECTURE HOURS, T-TUTORIAL HOURS, P-PRACTICAL HOURS, C-CREDITS,
I-INTERNAL MARKS, E-EXTERNAL MARKS, TM-TOTAL MARKS**

MECHANICAL ENGINEERING DEPARTMENT
B.TECH COURSE STRUCTURE

III SEMESTER

S NO	COURSE CODE	COURSE NAME	L	T	P	C	I	E	TM
1	BTME3T01	FLUID MECHANICS AND HYDRAULIC MACHINERY	3	1	--	3	30	70	100
2	BTME3T02	THERMODYNAMICS	3	1	--	3	30	70	100
3	BTME3T03	METALLURGY AND MATERIAL SCIENCE	3	1	--	3	30	70	100
4	BTME3T04	COMPUTER AIDED ENGINEERING DRAWING PRACTICE	1	--	3	3	30	70	100
5	BTBM3T01	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	3	1	--	3	30	70	100
6	BTCS3T03	OOPS THROUGH JAVA	3	1	--	3	30	70	100
7	BTME3L01	FLUID MECHANICS AND HYDRAULIC MACHINERY LAB	--	--	3	2	25	50	75
8	BTEE3L02	ELECTRICAL AND ELECTRONICS ENGG. LAB	--	--	3	2	25	50	75
9	BTBS3L01	SOFTSKILLS/APTITUDE LAB-1	--	--	2	1	25	--	25
TOTAL			16	05	11	23	255	520	775

IV SEMESTER

S NO	COURSE CODE	COURSE NAME	L	T	P	C	I	E	TM
1	BTME4T 01	MECHANICS OF SOLDS	3	1	--	3	30	70	100
2	BTME4T 02	IC ENGINES AND GAS TURBINES	3	1	--	3	30	70	100
3	BTME4T 03	PRODUCTION TECHNOLOGY	3	1	--	3	30	70	100
4	BTME4T 04	KINEMATICS OF MACHINERY	3	1	--	3	30	70	100
5	BTME4T05	MACHINE DRAWING	1	--	3	3	30	70	100
6	BTMA4T01	PROBABILITY AND STATISTICS	3	1	--	3	30	70	100
7	BTME4L01	PRODUCTION TECHNOLOGY LAB	--	--	3	2	25	50	75
8	BTME4L02	MECHANICS OF SOLDS & METALLURGY LAB	--	--	3	2	25	50	75
9	BTBS4L01	SOFTSKILLS/APTITUDE LAB-2	--	--	2	1	25	--	25
TOTAL			16	05	11	23	255	520	775

**L-LECTURE HOURS, T-TUTORIAL HOURS, P-PRACTICAL HOURS, C-CREDITS,
I-INTERNAL MARKS, E-EXTERNAL MARKS, TM-TOTAL MARKS**

MECHANICAL ENGINEERING DEPARTMENT
B.TECH COURSE STRUCTURE

V- SEMESTER

S NO	COURSE CODE	COURSE NAME	L	T	P	C	I	E	TM
1	BTME5T01	DYNAMICS OF MACHINERY	3	1	--	3	30	70	100
2	BTME5T 02	DESIGN OF MACHINE ELEMENTS	3	1	--	3	30	70	100
3	BTME5T 03	THERMAL ENGINEERING	3	1	--	3	30	70	100
4	BTME5T 04	MACHINE TOOLS	3	1	--	3	30	70	100
5	BTME5T 05	AUTOMOBILE ENGINEERING	3	1	--	3	30	70	100
6	BTMA5T01	OPERATIONS RESEARCH	3	1	--	3	30	70	100
7	BTME5L01	THERMAL ENGINEERING LAB	--	--	3	2	25	50	75
8	BTME5L02	MACHINE TOOLS LAB	--	--	3	2	25	50	75
9	BTME5S01	SEMINAR	--	--	2	2	50	-	50
TOTAL			18	06	08	24	280	520	800

VI- SEMESTER

S NO	COURSE CODE	COURSE NAME	L	T	P	C	I	E	TM
1	BTME6T 01	METROLOGY	3	1	--	3	30	70	100
2	BTME6T02	HEAT TRANSFER	3	1	--	3	30	70	100
3	BTME6T03	DESIGN OF MECHANICAL TRANSMISSION SYSTEMS	3	1	--	3	30	70	100
4	BTME6T04	ROBOTICS	3	1	--	3	30	70	100
5	BTBM6T01	INDUSTRIAL ENGINEERING MANAGEMENT	3	1	--	3	30	70	100
6		ELECTIVE – I	3	1	--	3	30	70	100
7	BTME6L01	METROLOGY LAB	--	--	3	2	25	50	75
8	BTME6L02	HEAT TRANSFER LAB	--	--	3	2	25	50	75
9	BTME6Q01	TECHNICAL PAPER	--	--	2	2	50	-	50
TOTAL			18	06	08	24	280	520	800

**L-LECTURE HOURS, T-TUTORIAL HOURS, P-PRACTICAL HOURS, C-CREDITS,
I-INTERNAL MARKS, E-EXTERNAL MARKS, TM-TOTAL MARKS**

MECHANICAL ENGINEERING DEPARTMENT
B.TECH COURSE STRUCTURE

VII – SEMESTER

S NO	COURSE CODE	COURSE NAME	L	T	P	C	I	E	TM
1	BTME7T01	CAD/CAM	3	1	--	3	30	70	100
2	BTME7T02	INSTRUMENTATION AND CONTROL SYSTEMS	3	1	--	3	30	70	100
3	BTME7T03	FINITE ELEMENT METHODS	3	1	--	3	30	70	100
4	BTME7T04	REFRIGERATION AND AIR CONDITIONING	3	1	--	3	30	70	100
5		ELECTIVE-II	3	1	--	3	30	70	100
7	BTME7L01	CAD/CAM LAB	--	--	3	2	25	50	75
8	BTME7L02	INSTRUMENTATION AND CONTROL SYSTEMS LAB	--	--	3	2	25	50	75
9	BTME7M01	MINI PROJECT	--	--	2	2	50	--	50
10	BTBM7T01	PROFESSIONAL ETHICS & INTELLECTUAL PROPERTY RIGHTS	3	--	--	--	Mandatory		
TOTAL			18	06	08	21	250	450	700

VIII- SEMESTER

S NO	COURSE CODE	COURSE NAME	L	T	P	C	I	E	TM
1	BTME8T01	PRODUCTION PLANNING AND CONTROL	3	1	--	3	30	70	100
		ELECTIVE – III	3	1	--	3	30	70	100
2		ELECTIVE-IV	3	1	--	3	30	70	100
3	BTME8V01	COMPREHENSIVE VIVA-VOCE	--	--	3	2	50	--	50
4	BTME8P01	PROJECT	--	--	6	6	60	140	200
TOTAL			10	02	09	17	200	350	550

**L-LECTURE HOURS, T-TUTORIAL HOURS, P-PRACTICAL HOURS, C-CREDITS,
I-INTERNAL MARKS, E-EXTERNAL MARKS, TM-TOTAL MARKS**

COURSE CODE	ELECTIVE-I	COURSE CODE	LECTIVE-II
BTME6TE1	1.MECHANICAL VIBRATIONS	BTME7TE1	1. ALTERNATIVE SOURCES OF ENERGY
BTME6TE2	2. UN-CONVENTIONAL MACHINING PROCESS	BTME7TE2	2. INDUSRIAL TRIBOLOGY
BTME6TE3	3. POWER PLANT ENGINEERING	BTME7TE3	3. INTERACTIVE COMPUTER GRAPHICS
BTCS6TE6	4.DATA BASE MANAGEMENT SYSTEMS	BTEC7TE6	4. NANO TECHNOLOGY

COURSE CODE	ELECTIVE-III	COURSE CODE	ELECTIVE-IV
BTME8TE1	1. RAPID PROTOTYPING	BTME8TE5	1. AUTOMATION IN MANUFACTURING
BTME8TE2	2. NON DESTRUCTIVE MATERIALS EVALUATION.	BTME8TE6	2. QUAITY CONTROL AND RELIABILITY ENGINEERING
BTME 8TE3	3.MICRO ELECTRO MECHANICAL SYSYSTEMS (MEMS)	BTME8TE7	3. COMPUTATIONAL FLUID DYNAMICS (CFD)
BTME8TE4	4.GREEN ENGINEERING SYSTEMS	BTME8TE8	4. PIPE LINE DESIGN

SEMESTER-I	L	T	P	C
	3	1	--	3
ENGLISH-I				

DETAILED TEXT-I English Essentials : Recommended Topics :

1. IN LONDON: M.K.GANDHI

OBJECTIVE: To apprise the learner how Gandhi spent a period of three years in London as a student.

OUTCOME: The learner will understand how Gandhi grew in introspection and maturity.

2. THE KNOWLEDGE SOCIETY- APJ KALAM

OBJECTIVE: To make the learners rediscover India as a land of Knowledge.

OUTCOME: The learners will achieve a higher quality of life, strength and sovereignty of a developed nation.

3. PRINCIPLES OF GOOD WRITING:

OBJECTIVE: To inform the learners how to write clearly and logically.

OUTCOME: The learner will be able to think clearly and logically and write clearly and logically.

4. MAN'S PERIL

OBJECTIVE: To inform the learner that all men are in peril.

OUTCOME: The learner will understand that all men can come together and avert the peril.

5. THE DYING SUN—SIR JAMES JEANS

OBJECTIVE: This excerpt from the book "The Mysterious Universe" presents the mysterious nature of the Universe and the stars which present numerous problems to the scientific mind. Sir James Jeans uses a poetic approach to discuss the scientific phenomena.

OUTCOME: This provides the students to think about the scientific phenomena from a different angle and also exposes the readers to poetic expressions.

6. LUCK—MARK TWAIN

OBJECTIVE: This is a short story about a man's public image and his true nature. The theme of the story is that luck can be a factor of life, so that even if one is incompetent but lucky, one can still succeed.

OUTCOME: The story is humourous in that it contains a lot of irony. Thus this develops in the learner understand humourous texts and use of words for irony.

Text Book : “English Essentials” by Ravindra Publications

NON-DETAILED TEXT: (From Modern Trailblazers of Orient Blackswan) (Common single Text book for two semesters) [Semester I (1 to 4 lessons)/Semester II (5 to 8 lessons)]

1. G. D. Naidu

OBJECTIVE: To inspire the learners by G. D. Naidu’s example of inventions and contributions.

OUTCOME: The learner will be in a position to emulate G. D. Naidu and take to practical applications.

2. G. R. Gopinath

OBJECTIVE: To inspire the learners by his example of inventions.

OUTCOME: Like G. R. Gopinath, the learners will be able to achieve much at a low cost and help the common man.

3. Sudhamurthy

OBJECTIVE: To inspire the learners by the unique interests and contributions of Sudhamurthy.

OUTCOME: The learner will take interest in multiple fields of knowledge and make life worthwhile through social service.

4. Vijay Bhatkar

OBJECTIVE: To inspire the learner by his work and studies in different fields of engineering and science.

OUTCOME: The learner will emulate him and produce memorable things.

Text Book: “Trail Blazers” by Orient Black Swan Pvt. Ltd. Publishers

SEMESTER-I	L	T	P	C
	3	1	-	3

DIFFERENTIAL EQUATIONS

UNIT – I: Differential equations of first order and first

degree Linear-Bernoulli-Exact-Reducible to exact.

Applications: Newton's Law of cooling-Law of natural growth and decay- Orthogonal trajectories.

UNIT – II: Linear differential equations of higher order Non-homogeneous equations of higher order with constant coefficients with RHS term of the type

e^{ax} , $\sin ax$, $\cos ax$, polynomials in x , $e^{ax}V(x)$, $xV(x)$. Method of Variation of parameters for solving second order linear differential equations

Applications: LCR circuit, Simple Harmonic motion

UNIT – III: Laplace transforms

Laplace transforms of standard functions-Shifting Theorems, Transforms of derivatives and integrals – Unit step function –Dirac's delta function-

UNIT – IV: Inverse Laplace transforms

Inverse Laplace transforms -Convolution theorem (without proof).

Application: Solutions of ordinary differential equations of using Laplace transforms.

UNIT – V: Mean value theorems (Without poof) & Partial Differentiation

Rolle's Theorem-Lagrange's mean value Theorem –Cauchy's mean value theorem - Taylor series and Maclaurin's series expansions of functions of single variable - Jacobian, Functional dependence.

UNIT – VI: First order Partial differential equations

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations-Solutions of Linear Partial differential equations with constant coefficients by the method of separation of Variables.

TEXT BOOKS:

1. **B.S. GREWAL**, Higher Engineering Mathematics, 42nd Edition, Khanna Publishers
2. **B.V. RAMANA**, Higher Engineering Mathematics, Tata McGraw Hill

REFERENCE BOOK:

1. **ERWIN KREYSZIG**, Advanced Engineering Mathematics, 9th Edition, Wiley-India

SEMESTER-I	L	T	P	C
	3	1	-	3
BASIC ELECTRICAL & ELECTRONICS				

UNIT – I: BASIC CONCEPTS, LAWS AND PRINCIPLES

Introduction – Atomic Structure and Electric Charge – Conductors, Insulators, and Semiconductors
 – Electric Field and Magnetic Field – Electric Current, Resistance, Potential, and Potential Difference

– Ohm’s Law – Work, Power and Energy – Electromagnetism and Electromagnetic Induction – Induced EMF – Inductance of a Coil – Electrical Circuit Elements (Resistor, Inductor, and Capacitor) – Voltage & Current Sources.

UNIT – II: AC FUNDAMENTALS

Generation of Alternating Voltage – Concept of Average Value and Root Mean Square Value of an Alternating Quantity – Behavior of R, L, and C in AC Circuits – Power in AC Circuits – AC Series & Parallel Circuits.

Three-Phase Circuits: Generation of Three Phase Voltages – Three-Phase Winding Connections (Y and Connections) – Measurement of Three-phase Power.

UNIT – III: MEASUREMENT AND MEASURING INSTRUMENTS

Introduction – Analog and Digital Instruments – Passive and Active Instruments – Static Characteristics – Linear and Non-linear Systems – Dynamic Characteristics – Classification of the Instrument System – Measurement Error – Indicating type Instruments – Measurement of Power, Measurement of Energy – Instrument Transformers – Megger & Measurement of Insulation Resistance – Multi-meter and Measurement of Resistance

UNIT – IV: SEMI CONDUCTOR DEVICES

Introduction – Binding Forces between Atoms in Semiconductor Materials – Extrinsic Semiconductors – Semiconductor Diodes – Zener Diode – Bipolar Junction Transistors – Field Effect Transistors – MOSFET – Silicon-controlled Rectifier – DIAC – TRIAC.

UNIT – V: DIGITAL ELECTRONICS

Introduction – Number Systems – Octal Number Systems – Hexadecimal Number System – Logic Gates – Boolean Algebra – De Morgan’s Theorem – Combinational Circuits – Simplification of Boolean Expressions using De Morgan’s Theorem – Universal Gates.

UNIT – VI: BASICS OF COMMUNICATION

Introduction – Elements of Communication Systems – Basic Electronic Communication – Bandwidth and its Significance – Types of Modulation – Comparison of Amplitude Modulation and Frequency Modulation – Demodulation -Basics of Microwave and Satellite Communication – Television Systems – Mobile Communication.

TEXT BOOK (S):

1. Basic Electrical and Electronics Engineering – S. K. Bhattacharya, Pearson Publications.
2. Basic Electrical & Electronics Engineering – J. B. Gupta, S. K. Kataria & Sons Publications.

REFERENCES:

1. Engineering Circuit Analysis – William H. Hayt & Jack E. Kemmerly, Tata McGraw-Hill Company, 7th Edition.
2. A Course in Electrical and Electronic Measurements and Instrumentation – A. K. Sawhney, Dhanpat Rai & Co.
3. Electronic Devices and Circuit Theory – Robert L. Boylestad & Louis Nashelsky, Prentice-Hall of India, 6th Edition.
4. Electrical & Electronics Engineering – J. B. Gupta, S. K. Kataria & Sons Publications.
5. Engineering Basics: Electrical, Electronics and Computer Engineering – Thyagarajan T., New Age International, 3rd edition (2007).

SEMESTER-I	L	T	P	C
	3	1	-	3
ENGINEERING PHYSICS				

UNIT – I: CRYSTALLOGRAPHY AND X-RAY**DIFFRACTION****(6hours)**

Introduction – Space lattice – Basis – Unit Cell – Lattice parameters – Crystal systems – Bravais lattices – Structures and packing fractions of SC, BCC and FCC-Directions and planes in crystals – Miller indices – Separation between successive (h k l) planes – Bragg's law- Bragg's Spectrometer.

UNIT – II: QUANTUM MECHANICS FOR ELECTRONIC TRANSPORT

QUANTUM MECHANICS AND ELECTRON THEORY OF METALS: Schrodinger Time Independent and Time Dependent wave equations – Particle in a box – Classical free electron theory – electrical conductivity – Mean free path – Relaxation time and drift velocity – Quantum free electron theory – Fermi – Dirac distribution function (analytical) and its dependence on temperature – Fermi energy.

BAND THEORY OF SOLIDS: Bloch theorem (qualitative) – Kronig – Penney model – Origin of energy band formation in solids – Classification of materials into conductors, semi – conductors & insulators – Concepts of effective mass of electron and concept of hole.

UNIT – III: MAGNETIC RESPONSE OF MATERIALS & SUPERCONDUCTIVITY

MAGNETIC PROPERTIES : Magnetic permeability – Magnetization – Origin of magnetic moment – Classification of Magnetic materials – Dia, Para, Ferro, Anti-Ferro and Ferri-magnetism – Hysteresis curve by Weiss Domain Theory -Soft and Hard Magnetic materials

SUPERCONDUCTIVITY: General properties – Meissner effect – Type I and Type II superconductors – London's equations – Penetration depth – BCS Theory- Flux quantization – DC and AC Josephson effects-Applications of Superconductors .

UNIT – IV: COHERENT OPTICS – COMMUNICATIONS AND STRUCTURE OF MATERIALS

LASERS: Introduction – coherent sources – Characteristics of lasers – Spontaneous and Stimulated emission of radiation – Einstein’s coefficients – three level and four level laser pumping schemes – Population inversion – Ruby laser – Helium-Neon laser- Applications of Laser.

FIBER OPTICS: Introduction-Principle of wave propagation in Optical Fiber-Acceptance angle and acceptance cone-Numerical aperture-Types of optical fibers - Application of optical fibers.

UNIT – V: SEMICONDUCTOR PHYSICS

Introduction – Intrinsic semiconductor and carrier concentration – Equation for conductivity – Extrinsic semiconductor and carrier concentration – Drift and diffusion – Einstein’s equation – Hall Effect – direct & indirect band gap semiconductors.

UNIT – VI: DIELECTRIC PROPERTIES& ACOUSTICS

DIELECTRIC PROPERTIES: Introduction - Dielectric constant - Electronic, ionic and orientation polarizations - Internal fields in solids - Clausius-Mossotti equation - Ferro and Piezo electricities.

ACOUSTICS: Sound absorption, absorption coefficient and its measurements, Reverberations time – Sabine’s formula, Eyring’s formula.

TEXT BOOKS

1. A Text Book of Engineering Physics by M. N. Avadhanulu & P. G. Kshirasagar (S. Chand publications)
2. Engineering Physics by Mani Naidu S (Pearson Publications)

REFERENCE BOOKS

1. Introduction to solid state physics by Charles Kittle (Wiley India Pvt.Ltd)
2. Applied Physics by T. Bhimasankaram (BSP BH Publications)
3. Applied Physics by M. Arumugam (Anuradha Agencies)
4. Engineering Physics by Palanisamy (Scitech Publishers)
5. Engineering Physics by D.K.Bhattacharya (Oxford University press)
6. Engineering Physics by Sanjay D Jain and Girish G Sahasrabudhe (University Press)
7. Engineering Physics by B.K.Pandey & S. Chaturvedi (Cengage Learning)

SEMESTER-I	L	T	P	C
	3	1	-	3
C-PROGRAMMING				

UNIT-I:**INTRODUCTION:**

Introduction to Computer System, Hardware and Software, Algorithm, Flowchart, Types of Computer Languages.

FUNDAMENTALS OF C:

C Character Set, Tokens, Identifiers, Constants, Basic Data Types and Sizes, Operators: Arithmetic Operators, Relational Operators, Logical Operators, Conditional Operator, Increment and Decrement Operators, Assignment Operators, Bit-wise Operators, Special Operators, Expressions, Operator Precedence and Order of Evaluation, Evaluation of Expressions, Type Conversions: Implicit and Explicit.

UNIT-II:**CONTROL STRUCTURES:**

Selection Statements: if-else Statement, null else Statement, nested if Statement, else-if Statement, switch Statement, Applications.

Iterative Statements: break statement, continue statement, counter and event controlled loops, while loop, do-while loop, for loop, Looping Applications.

ARRAYS:

Introduction to arrays, declaration, initialization and accessing array elements of 1-D Arrays, declaration, initialization and accessing elements of 2-D Arrays, Strings, String Functions, Application of Arrays.

UNIT-III:**FUNCTIONS:**

Introduction to Functions, User-Defined & Library Functions, Parameter Passing, Return Statement Storage Class, Recursion, Recursive Functions and Recursive Solutions for different problems, C Preprocessor, Passing 1-D Arrays and 2-D Arrays to Functions.

NIT-IV:**POINTERS:**

Introduction to Pointers, Declaration, Initialization and Accessing a Pointer, Passing by Address, Pointer as Function Argument, Pointer Arithmetic, Pointer to Pointer, Pointer to Multi-dimensional Arrays, Dynamic Memory Management Functions, Command Line Arguments.

UNIT-V:**DERIVED TYPES:**

Definition, Declaration and Initialization of Structures, Accessing Structures, Nested structures, Array of Structures, Structures and Functions, pointer to structure, Self-Referential Structures, bit-fields, Definition, Declaration and Initialization of Unions, Type-definition.

UNIT-VI:**FILES:**

Introduction to Files, File Streams: binary and text, Formatted I/O functions: fprintf(), fscanf(), and File I/O Functions: feof(), rewind(), ferror(), fopen(), fclose().

TEXT BOOKS:

The C Programming Language	Kernighan & Ritchie	PHI
Programming in C: A Practical Approach	Ajay Mittal	Pearson
Programming in ANSI C	E Balagurusamy	TMH

REFERENCE BOOKS:

Understanding and using C Pointers	Richard Reese	Oreilly
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SEMESTER-I	L	T	P	C
	1	--	3	3
ENGINEERING DRAWING				

UNIT – I:

INTRODUCTION: Engineering Drawing and Plane Curves, Use of Drawing Instruments and Conventions.

GEOMETRICAL CONSTRUCTIONS: Constructions of Polygons using General Method-

CONICS: Construction of Ellipse, Parabola and Hyperbola by Eccentricity Method.

CYCLOIDAL CURVES: Construction of Cycloid, Epi-Cycloid and Hypo-Cycloid.

UNIT – II:

PROJECTIONS OF POINTS AND LINES: Introduction to Orthographic Projections - Projection of Points, **PROJECTION OF STRAIGHT LINES:** Parallel to both the Planes, Parallel to One Plane and Inclined to Other Plane, Inclined to Both the Planes.

UNIT – III:

PROJECTIONS OF PLANES: Introduction to Perpendicular Planes, Perpendicular to both the Reference Planes, Perpendicular to One Plane and Parallel to Other Plane, Perpendicular to One Plane and Inclined to Other Plane, Inclined to Both the Reference Planes.

UNIT – IV:

PROJECTIONS OF SOLIDS: Projections of Simple Solids like Prism, Cylinder, Pyramids and Cones. Projections of Solids with Axis Perpendicular to one Plane, Projections of Solids with Axis Parallel to Both the Planes.

UNIT – V:

PROJECTIONS OF SOLIDS – AXIS INCLINED TO ONE PLANE: Projections of Solids with Axis inclined to one plane and parallel to other Plane (Axis inclined to the VP and Parallel to the HP, Axis Inclined to the HP and Parallel to the VP).

UNIT – VI:

ISOMETRIC PROJECTIONS: Principles of Isometric Projections - Isometric Scale, Isometric Projections of Planes, Simple Solids, Conversion of Isometric to Orthographic Views and Vice Versa.

TEXT BOOKS:

1. Engineering Drawing by K.L. Narayana & P. Khannaiah., SCIETECH Publishers.
2. Engineering Drawing by M.B. Shah & B.C. Rana., Pearson's Publishers.

REFERENCE BOOKS:

1. Engineering Drawing by N.D. Bhatt, Charotar Publishers.
2. Engineering Drawing by K. Venugopal., NEW AGE Publications.

SEMESTER-I	L	T	P	C
	--	--	3	2
ENGLISH COMMUNICATION SKILLS LAB –I				

OBJECTIVE: To impart to the learner the skills of grammar as well as communication through listening, speaking, reading, and writing including soft, that is life skills.

BASIC COMMUNICATION SKILLS

UNIT 1

- A. Greeting and Introductions
- B. Pure Vowels

UNIT 2

- A. Asking for information and Requests
- B. Diphthongs

UNIT 3

- A. Invitations
- B. Consonants

UNIT 4

- A. Commands and Instructions
- B. Accent and Rhythm

UNIT 5

- A. Suggestions and Opinions
- B. Intonation

TEXT BOOK:

‘Strengthen your Communication Skills’ Part-A by Maruthi Publications

REFERENCE BOOKS:

- 1 INFOTECH English (Maruthi Publications)
- 2 Personality Development and Soft Skills (Oxford University Press, New Delhi)

SEMESTER-I	L	T	P	C
	--	--	3	2
ENGINEERING PHYSICS LAB				

Student has to do Any Ten Experiments of the Following

- 1 Determination of the Rigidity Modulus of given material wire using Torsional Pendulum.
- 2 Determination of the Acceleration due to Gravity and Radius of Gyration using Compound Pendulum.
- 3 Determination the Frequency of vibration in Transverse and Longitudinal Modes using Melde's Apparatus.
- 4 Determination Frequency of A.C supply by using Sonometer
- 5 Determination of wavelength using Laser.
- 6 Determination of Numerical Aperture of an Optical Fiber.
- 7 Determination of the Planck's constant using Photo-Cell.
- 8 Study the variation of Magnetic Field along the axis of a solenoid coil using Stewart-Gee's Apparatus.
- 9 Determination of the Time Constant for a C-R Circuit.
- 10 Determination of the Band Gap of a Semiconductor using a p-n junction diode.
- 11 Study of Characteristic curves (I/V) of a Zener diode to determine its Breakdown voltage.
- 12 Determination of Thermoelectric coefficient of a Thermistor by using its Characteristic curve.

MANUAL:

1. Engineering Physics Lab Manual Prepared by Physics Faculty.

SEMESTER-I	L	T	P	C
	--	--	3	2
COMPUTER PROGRAMMING LAB				

Exercise 1

- A Write a C Program to calculate the area of triangle, circumference of a circle.
- B Write a C program to find the largest of three numbers using ternary operator.
- C Write a C Program to swap two numbers without using a temporary variable.

Exercise 2

- a) Write a C program to find the roots of a Quadratic Equation.
- b) 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)

Exercise 3

- a) Write a C program to find the sum of individual digits of a positive integer and find the reverse of the given number.
- b) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence
- c) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Exercise 4

- a) Write a C Program to print the multiplication table of a given number n up to a given value, where n is entered by the user.
- b) Write a C Program to enter a decimal number, and calculate and display the binary equivalent of that number.
- c) Write a C Program to check whether the given number is Armstrong number or not & Perfect number or not.

Exercise 5

- a) Write a C program to interchange the largest and smallest numbers in the array.
- b) Write a C program to Search an element in the array using linear search.

Exercise 6

Write a C program to input two $m \times n$ matrices, check the compatibility and perform addition and multiplication of them

Exercise 7

Write a C program that uses functions to perform the following operations:

- a) To insert a sub-string in to given main string from a given position.
- b) To delete n Characters from a given position in a given string.
- c) To replace a character of string either from beginning or ending or at a specified location

Exercise 8

- a) Write C Programs for the following string operations without using the built in functions -
to concatenate two strings - to append a string to another string - to compare two strings

Exercise 9

- a) Write C Programs for the following string operations without using the built in functions - to
find the length of a string - to find whether a given string is palindrome or not

Exercise 10

- a) Write a C functions to find both the largest and smallest number of an array of integers.
- b) Write C programs illustrating call by value and call by reference concept.

Exercise 11

Write C programs that use both recursive and non-recursive functions for the following

- a) To find the factorial of a given integer.
- b) To find the GCD (greatest common divisor) of two given integers.
- c) To find Fibonacci sequence

Exercise 12

- a) Write a C program consisting of Pointer based function to exchange value of two integers
using passing by address.
- b) Write a C program to swap two numbers using pointers
- c) Write a C Program to compare two arrays using pointers

Exercise 13

Examples which explores the use of structures, union and other user defined variables

Exercise 14

- a) Write a C program which copies one file to another using command line argument.
- b) Write a C program to count the number of characters and number of lines in a file.
- c) Write a C Program to merge two files into a third file. The names of the files must be entered using command line arguments.

SEMESTER-II	L	T	P	C
	3	1	--	3
ENGLISH –II				

DETAILED TEXT-II : Sure Outcomes: English for Engineers and Technologists

Recommended Topics :

1. TECHNOLOGY WITH A HUMAN FACE

OBJECTIVE: To make the learner understand how modern life has been shaped by technology.

OUTCOME: The proposed technology is people's technology. It serves the human person instead of making him the servant of machines.

2. CLIMATE CHANGE AND HUMAN STRATEGY

OBJECTIVE: To make the learner understand how the unequal heating of earth's surface by the Sun, an atmospheric circulation pattern is developed and maintained.

OUTCOME: The learner's understand that climate must be preserved.

3. EMRGING TECHNOLOGIES

OBJECTIVE: To introduce the technologies of the 20th century and 21st centuries to the learners.

OUTCOME: The learner will adopt the applications of modern technologies such as nanotechnology.

4. WATER- THE ELIXIR OF LIFE

OBJECTIVE: To inform the learner of the various advantages and characteristics of water.

OUTCOME: The learners will understand that water is the elixir of life.

5. THE SECRET OF WORK

OBJECTIVE: In this lesson, Swami Vivekananda highlights the importance of work for any development.

OUTCOME: The students will learn to work hard with devotion and dedication.

6. WORK BRINGS SOLACE

OBJECTIVE: In this lesson Abdul Kalam highlights the advantage of work.

OUTCOME: The students will understand the advantages of work. They will overcome their personal problems and address themselves to national and other problems.

Text Book :

“Sure Outcomes” by Orient Black Swan Pvt. Ltd. Publishers

NON-DETAILED TEXT:

(From Modern Trailblazers of Orient Blackswan)
(Common single Text book for two semesters)
(Semester I (1 to 4 lessons)/ Semester II (5 to 8 lessons))

7. J.C. Bose

OBJECTIVE: To apprise of J.C.Bose’s original contributions.

OUTCOME: The learner will be inspired by Bose’s achievements so that he may start his own original work.

8. HomiJehangirBhabha

OBJECTIVE: To show Bhabha as the originator of nuclear experiments in India.

OUTCOME:The learner will be inspired by Bhabha’s achievements so as to make his own experiments.

9. Vikram Sarabhai

OBJECTIVE: To inform the learner of the pioneering experiments conducted by Sarabhai in nuclear energy and relevance of space programmes.

OUTCOME: The learner will realize that development is impossible without scientific research.

10. A Shadow- R.K.Narayan

OBJECTIVE: To expose the reader to the pleasure of the humorous story

OUTCOME: The learner will be in a position to appreciate the art of writing a short story and try his hand at it.

TEXT BOOK :

“Trail Blazers” by Orient Black Swan Pvt. Ltd. Publishers

SEMESTER-II	L	T	P	C
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LINEAR ALGEBRA & VECTOR CALCULUS				

UNIT I: Linear systems of equations

Rank-Echelon form, Normal form – Solution of Linear Systems – Direct Methods- Gauss Elimination- Gauss Jordan and Gauss Seidal Methods.

Application: Finding the current in an electrical circuit.

UNIT II: Eigen values - Eigen vectors and Quadratic forms

Eigen values - Eigen vectors– Properties (without proof)– Cayley-Hamilton Theorem (without proof) Quadratic forms- Reduction of quadratic form to canonical form – Rank, index, signature and nature of the Quadratic form.

Applications: Finding Inverse and powers of a matrix by using Cayley-Hamilton theorem.

UNIT III: Multiple integrals

Multiple integrals - Double and triple integrals – Change of variables – Change of order of Integration

Application: Applications of Integration to Lengths, Volumes and Surface areas of solids of revolution in Cartesian and Polar Coordinates.

UNIT IV: Special functions

Beta and Gamma functions- Properties - Relation between Beta and Gamma functions

Application: Evaluation of improper integrals.

UNIT V: Vector Differentiation

Gradient- Divergence- Curl - Laplacian and second order operators Vector identities

Application: Equation of continuity, potential Surface

UNIT VI: Vector Integration

Line integral – work done – Potential function – area- surface and volume integrals Vector integral theorems: Greens, Stokes and Gauss Divergence Theorems (without proof) and related problems.

Application: Work done by a force

TEXT BOOKS:

1. **B.S. GREWAL**, Higher Engineering Mathematics, 42nd Edition, Khanna Publishers
2. **B.V. RAMANA**, Higher Engineering Mathematics, Tata McGraw Hill

REFERENCE BOOKS:

1. **ERWIN KREYSZIG**, Advanced Engineering Mathematics, 9th Edition, Wiley-India
2. **S. S. SASTRI (PHI)**, Introductory Methods of Numerical Analysis.
3. **V. RAVINDRANADH, P. VIJAYA LAXMI**, A Text Book on Mathematical Methods by Himalaya Publishing House.

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NUMERICAL METHODS & INTEGRAL TRANSFORMS				

UNIT – I: Solution of Algebraic and Transcendental Equations

Introduction- Bisection Method – Method of False Position – Iteration Method – NewtonRaphson Method.

UNIT – II: Interpolation

Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences –Central differences – Symbolic relations and separation of symbols, Differences of a polynomial-Newton’s formulae for interpolation – Interpolation with unevenly spaced points – Lagrange’s Interpolation formula

UNIT – III: Numerical solution of Ordinary Differential equations

Solution by Taylor’s series-Picard’s Method of successive Approximations - Euler’s Method– Runge-Kutta Methods

UNIT – IV: Fourier Series

Introduction- Determination of Fourier coefficients – even and odd functions –change of interval– Half-range sine and cosine series

UNIT – V: Fourier Transforms

Fourier integral theorem (only statement) – Fourier sine and cosine integrals - sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms

UNIT –VI: Z-transform

Introduction– properties – Damping rule – Shifting rule – Initial and final value theorems - Inverse z transform- -Convolution theorem.

Applications: Solution of difference equation by Z-transforms.

TEXT BOOKS:

1. **B.S. GREWAL**, Higher Engineering Mathematics, 42nd Edition, Khanna Publishers
2. **B.V. RAMANA**, Higher Engineering Mathematics, Tata McGraw Hill
3. **V. RAVINDRANADH, P. VIJAYA LAXMI**, A Text Book on Mathematical Methods by Himalaya Publishing House.

REFERENCE BOOKS:

1. **ERWIN KREYSZIG**, Advanced Engineering Mathematics, 9th Edition, Wiley-India
2. **S. S. Sastri (PHI)**, Introductory Methods of Numerical Analysis

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ENGINEERING CHEMISTRY				

UNIT – I: WATER TECHNOLOGY

Hard Water – Estimation of Hardness By EDTA Method – Potable Water - Sterilization and Disinfection – Boiler Feed Water – Boiler Troubles – Priming And Foaming , Scale Formation, Corrosion, Caustic Embrittlement, Turbine Deposits – Softening of Water – Lime Soda, Zeolite Processes – Ion Exchange Process - Reverse Osmosis – Electro Dialysis.

UNIT – II: ELECTRO CHEMISTRY

Electro Potential –Determination of single electrode potential –Standard electrode potential - Nernst Equation(problems) – Electro Chemical cell (Galvanic Cell) -Reference Electrodes- Standard Hydrogen Electrode, Calomel Electrode -- Ion Selective Electrode –Glass electrode – Determination of pH –conductometric titration- Potentiometric titrations-Batteries – Primary Cell: Dry Cell, Alkaline Battery – Secondary Cell: Lead Acid Accumulator, Lithium Ion Battery – Fuel Cells – Hydrogen – Oxygen Fuel Cell, Methanol – Oxygen Fuel Cell- solar cell - Photovoltaic Cell-Applications.

UNIT – III: CORROSION

Introduction - Theories of Corrosion(i) Dry Corrosion (Pilling Bed worth rule) (ii) Wet Corrosion – Galvanic Series – Types of Corrosion: Galvanic Corrosion, Differential Aeration Corrosion, Pitting Corrosion, Stress Corrosion – Factors Influencing Corrosion – Nature of The Metal , Nature of The Environment – Corrosion Control: Material Selection & Design – Cathodic Protection- Surface Coatings – Methods of Applications on Metals -Hot Dipping, Electroplating, Electroless Plating) – Organic Surface Coating – Paints – Their Constituents & Their Function.

UNIT – IV: FUELS

Introduction to Fuels – Classification – Solid Fuels Merits & Demerits - Calorific Value – HCV and LCV– Bomb Calorimeter - Problems Based on Calorific Values – Analysis of Coal (Proximate and Ultimate Analysis) – Numerical Problems Based on Analysis – Working of Thermal Power Station; Liquid Fuels Merits & Demerits – Petroleum – Refining – Cracking (types) –Petrol – Diesel Knocking– Octane Number, Cetane Number - Gaseous Fuels Merits & Demerits – Natural Gas – LPG, CNG.

UNIT – V: POLYMERS SCIENCES & TECHNOLOGY

POLYMERS – Introduction – Types of Polymers – Mechanism of Polymerization (Addition and Condensation) – Individual Polymers (Preparation Properties and uses of PS, PVC and Bakelite) Conducting Polymers – Biodegradable Polymers – Stereo Specific Polymers, Ziegler Natta Catalysis. PLASTIC – Types – Compounding of Plastics – Moulding (Four Types) – Fiber Reinforced Plastics - Bullet Proof Plastics – Engineering Applications.

RUBBER & ELASTOMERS: Introduction – Preparation – Vulcanization – Compounding of Rubber – Preparation, Properties and Uses of Buna-S, Buna-N and Thiokol-Engineering Applications.

UNIT – VI: ENGINEERING MATERIALS

Refractories – Ceramics (Types, Properties Applications) – Cement – Hardening and Setting- Deteriorations of cement concrete – Nanomaterials (Preparation, Properties & Applications of Carbon Nano tubes) – Definitions of Green Chemistry – Principle – Engineering Applications.

TEXT BOOKS

- 1) Jain and Jain (Latest Edition), Engineering Chemistry, Dhanpat Rai Publishing company Ltd.
- 2) N. Y. S. Murthy, V. Anuradha, K Ramana Rao” A Text Book of Engineering Chemistry”, Matuthi Publications.
- 3) K.Sesha Maheswaramma and Mridula Chugh (2013) A Text Book of Engineering Chemistry,

REFERENCE BOOKS:

1. Shashi Chawal “A Text Book of Engineering Chemistry, Dhanpat Rai Publishing company Ltd,
2. S. S. Dara (2013) Text Book of Engineering Chemistry, S. Chand Technical Series.

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ENGINEERING MECHANICS				

UNIT – I:

SYSTEM OF FORCES: Introduction, Laws of Mechanics, Co-planar concurrent forces, Parallelogram Law, Triangle Law, Polygon Law, Free Body Diagram, Lami's Theorem, Moment of Forces and its applications, Couples, resultant of Force systems, Components in Space.

UNIT – II:**FRICITION:**

Introduction, Angle of Repose, Laws of Friction, and Friction of Bodies moving Up and Down on an Inclined Plane, Wedge Friction, Screw Jack.

UNIT – III:

CENTROID AND CENTER OF GRAVITY: Centroid of simple figures and Centroid of Composite figures. Center of Gravity of simple Bodies and Center of Gravity of Composite Bodies, Pappus Theorem.

UNIT – IV:

MOMENT OF INERTIA: Introduction, Polar Moment of Inertia, Radius of Gyration, Parallel Axis Theorem, Moment of Inertia of Composite Areas, Product of Inertia.

MASS MOMENT OF INERTIA: Introduction, Radius of Gyration, Transfer Formula for Composite Bodies.

UNIT – V:**KINETICS AND KINEMATICS:**

KINETICS: Analysis as a Particle and analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

KINEMATICS: Rectilinear and Curvilinear Motion – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.

UNIT – VI:**WORK-ENERGY METHOD:**

Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.

TEXT BOOKS:

1. ENGINEERING
MECHANICS -A.K.TAYAL – UMESH Publications.
2. ENGINEERING
MECHANICS -BASUDEB BHATTACHARYA – Oxford University
Press.
3. ENGINEERING
MECHANICS -A. NELSON, Mc Graw Hill Publications.

REFERENCE BOOKS:

1. ENGINEERING
MECHANICS - S. Timoshenko & D.H. Young, McGraw Hill
2. ENGINEERING
MECHANICS - Ferdinand L. Singer, Harper Collins
Publishers
3. ENGINEERING
MECHANICS - S. S. Bhavikatti, New Age Publishers.

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ENVIRONMENTAL STUDIES				

UNIT – I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, Scope and Importance -Sustainability: Stockholm and Rio Summit–Global Environmental

Challenges: Global warming and climate change, acid rains, ozone layer depletion.

UNIT – II: NATURAL RESOURCES: NATURAL RESOURCES AND ASSOCIATED PROBLEMS

Forest resources – Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.

Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources

Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity

Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.

Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable life styles.

UNIT – III: ECOSYSTEM, BIODIVERSITY AND ITS CONSERVATION

Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems. Definition: genetic, species and ecosystem diversity- classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels - India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. -

Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.

UNIT – IV: ENVIRONMENTAL POLLUTION

Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies.

Solid Waste Management: Sources, classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products.

UNIT – V: SOCIAL ISSUES AND THE ENVIRONMENT

Population growth and explosion, effects. Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Role of information Technology in Environment and human health. Environmental Protection Act - Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act – Motor Vehicle Act - Issues involved in enforcement of environmental legislation -Public awareness.

UNIT – VI: ENVIRONMENTAL MANAGEMENT

Environmental ethics - Issues and possible solutions and Environmental Education - Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism The student should submit a report individually on any issues related to Environmental Studies course and make a power point presentation – Field work: visit to an industrial area/ecosystem area (Forest, Grassland, Desert, and Aquatic)

TEXT BOOK:

- a. Environmental Studies by K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada
- b. A text book of Environmental Studies by C. P. Kaushik & Anubha Kaushik, New Age international publishers.

REFERENCE BOOKS:

1. Text Book of Environmental Studies by Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. A text book of Environmental Studies by Shaashi Chawla, TMH, New Delhi.

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ENGLISH COMMUNICATION SKILLS LAB –II				

Suggested Lab Manuals:

OBJECTIVE: To impart to the learner the skills of grammar as well as communication through listening, speaking, reading, and writing including soft, that is life skills.

ADVANCED COMMUNICATION SKILLS

- UNIT 6 Body Language

- UNIT 7 Dialogues

- UNIT 8 Interviews and Telephonic Interviews

- UNIT 9 Group Discussions

- UNIT 10 Presentation Skills

- UNIT 11 Debates

TEXT BOOK:

‘Strengthen your Communication Skills’ Part-B by Maruthi Publications

REFERENCE BOOKS:

1. INFOTECH English (Maruthi Publications)
2. Personality Development and Soft Skills (Oxford University Press, New Delhi)

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ENGINEERING CHEMISTRY LAB				

List of Experiments

Student has to do Any Ten Experiments of the Following

Introduction to chemistry lab

Estimation of HCl using standard Na₂CO₃

Analysis of Water

1. Determination of Total hardness of water
2. Estimation of Ferric iron
3. Estimation of KMnO₄ using standard H₂C₂O₄
4. Estimation of Copper (Iodometry)
5. Estimation of Dissolved Oxygen by Winkles Method
6. Determination of pH the of given water sample
7. Conductometric titration of strong acid Vs Strong base.
8. Potentiometric Titration of Strong Acid Vs Strong Base
9. Preparation of Phenol-Formaldehyde Resin

Estimation of properties of Oil

- 1 Acid Number
- 2 Saponification value

MANUAL:

1. Engineering Chemistry Lab Manual Prepared by Chemistry Faculty.

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ENGINEERING WORKSHOP PRACTICE				

COURSE OBJECTIVE: To impart hands – on practice on basic engineering trades and skills.

NOTE: At least two exercises to be done from each trade.

TRADE;

CARPENTRY;

1. CROSS LAP JOINT
2. DOVE-TAIL JOINT
3. MORTISE AND TENNON JOINT

FITTING:

1. SQUARE FIT
2. V-FIT
3. HALF ROUND FIT

FORGING:

1. ROUND ROD TO SQUARE
2. S-HOOK
3. ROUND ROD TO SQUARE HEADED BOLT

HOUSE WIRING:

1. PARALLEL/SERIES CONNECTION OF THREE BULBS
2. STAIR CASE WIRING
3. FLOURESCENT LAMP FITTING

SHHET METAL:

1. SQUARE TRAY
2. HOLLOW CYLINDER
3. OPEN SCOOP

MANUAL:

1. Engineering Work Shop Practice Lab Manual Prepared by Mechanical Faculty.

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FLUID MECHANICS ANDHYDRAULIC MACHINERY				

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 pressure –measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT II

FLUID KINEMATICS: Stream line, path line, streak lines and stream tube-Classification of flows-steady & unsteady, uniform, non-uniform, laminar, turbulent, rotational, and irrational flows-Equation of continuity for one dimensional flow.

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

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: pilot tube, venture meter, orifice meter and 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, Force exerted by jet of water on series of vanes.

UNIT V

HYDRAULIC TURBINES: Classification of turbines, 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 VI

CENTRIFUGAL PUMPS: Classification, working, work done – manometric head-losses and efficiencies specific speed- pumps in series and parallel-performance characteristic curves, NPSH.

RECIPROCATING PUMPS: Working, Discharge, slip, indicator diagrams.

TEXT BOOKS:

1. Hydraulics, fluid mechanics by P.N. MODI and S.M.SETH, Standard book house.
2. A text book of Fluid Mechanics and Hydraulic Machines by R.K.Bansal, Laxmi Publications.

REFERENCES:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.

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THERMODYNAMICS				

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, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale.

UNIT II

FIRST LAW OF THERMODYNAMICS : Perfect Gas Laws – Equation of State, specific and Universal Gas constants – Joule’s Experiments – First law of Thermodynamics – Corollaries – PMM I - First law applied to a Process –various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes, First law applied to a flow system – Steady Flow Energy Equation. – Flow processes – Deviations from perfect Gas Model – Vander Waals Equation of State – Compressibility charts

UNIT – III

SECOND LAW OF THERMODYNAMICS :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 IV

PROPERTIES OF PURE SUBSTANCES : 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.

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.

UNIT – VI

REFRIGERATION CYCLES: Brayton and Rankine cycles – Performance Evaluation – combined cycles, Bell- Coleman cycle, Vapour compression cycle-performance Evaluation.

TEXT BOOKS:

- 1 A Text Book of Engineering Thermodynamics- Fourth Edition, R.K. Rajput-Laxmi Publications
- 2 Engineering Thermodynamic - P.K. Nag, 4th Edition, Tata McGraw Hill Education Private Limited, New Delhi.

REFERENCES:

- 1 K. Ramakrishna (2011), *Engineering Thermodynamics*, 2nd edition, Anuradha Publishers, India.
- 2 Thermodynamics – An Engineering Approach – Yunus Cengel & M.A.Boles , Tata McGraw Hill Publishing Company Limited, New Delhi.
- 3 An introduction to Thermodynamics- Y. V. C. Rao, Revised Edition, Universities Press, Hyderabad, India.

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METALLURGY AND MATERIALSCIENCE				

UNIT – I

STRUCTURE OF METALS: Bonds in Solids–Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size.

CONSTITUTION OF ALLOYS: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT -II

EQUILIBRIUM DIAGRAMS : Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cus-Sn and Fe-Fe₃C.

UNIT -III

CAST IRONS AND STEELS : Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

UNIT – IV

HEAT TREATMENT: Effect of alloying elements on Fe-Fe₃C system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT - V

NON-FERROUS METALS AND ALLOYS: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

UNIT – VI

CERAMIC MATERIALS: Crystalline ceramics, glasses, cermates, abrasive materials, Nano materials–definition, properties and applications of the above.

COMPOSITE MATERIALS: Classification of composites, various methods of component manufacture of composites, particle, reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C – C composites.

TEXT BOOKS:

1. Introduction to Physical Metallurgy - Sidney H. Avener, Tata McGraw Hill Edition.
2. Material Science and Engineering - V. Rahghavan , PHI Publications

REFERENCES:

1. Material science and metallurgy by V.D. Kodgire, S.V.Kodgire, Everest Publishing House.
2. Engineering materials and metallurgy - R.K.Rajput, S.Chand & company, New Delhi.

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COMPUTER AIDED ENGINEERING DRAWING PRACTICE				

UNIT – I**PROJECTIONS OF SOLIDS:**

Projection of regular solids inclined to both the planes, Auxiliary views and sectional views of Regular solids.

UNIT –II

DEVELOPMENT OF SURFACES OF RIGHT REGULAR SOLIDS-Prisms, cylinders, pyramids, cone and their parts Interpenetration and Intersection of right regular solids

UNIT –III

ISOMETRIC PROJECTIONS AND ORTHOGRAPHIC PROJECTIONS- Plane figures, simple and compound solids, isometric projections of objects having non-isometric lines and spherical parts. Perspective Projections-perspective view of points, lines, plane figures and simple solids, vanishing point method

UNIT-IV

INTRODUCTION TO COMPUTER AIDED DRAFTING- Generation of points, lines, curves, polygons, dimensioning. Types of modeling-Object selection commands, edit, zoom, cross, hatching, pattern filling, utility commands in object selection commands, 2D and 3D wire frame modeling

UNIT-V

VIEW POINTS AND VIEW PORTS-view point coordinates and views displayed, examples to exercise different options like save , restore, delete, joint, single option

UNIT-VI

COMPUTER AIDED SOLID MODELING- Isometric projections, orthographic projections of isometric projections, modeling of simple solids, machines and machine parts

TEXT BOOKS:

- 1 Engineering Drawing by N.D.Bhatt , Charotar Publications
- 2 Text book of Engineering Drawing with AutoCAD - K.Venkata reddy / B.S.Publications

REFERENCE BOOKS:

1. Engineering Drawing - R.K. Dhawan,S.Chand
2. Engineering Drawing - K.L.Narayana, P.Kannaiah, and K.Venkata Reddy/ New Age

International Publisher Mode of examination for Computer Aided Engineering Drawing
The syllabus in respect of the subject "Computer Aided Graphics" for B Tech III sem students consists of two major portions

1. Unit I to III - conventional drawing pattern
2. Unit IV to VII - computer lab pattern using any drafting packages

Class work - 4 hrs per week Credits - 3

Max Marks - 100 Internal Marks: 30 & External Marks: 70

The examination in respect of the above may conducted on par with lab with the following pattern: Mid Exam: I Mid Exam from first Three Units - Conventional Drawing Exam

1. Mid Exam from Last three Units - In Computer Lab End Exam duration - 4 hrs

Part A - Conventional Drawing test in Drawing Hall from first FOUR Units - 2 hrs duration.

Part B - Exam in Computer Lab using any drafting package - 2 hrs duration.

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MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS				

UNIT –I: Managerial Economics & Demand Analysis:

Definition – Nature and Scope - Relation with other disciplines - Concept of Demand-Types- Determinants - Law of Demand – Exceptions - Elasticity of Demand - Types and Measurement- Demand forecasting and its Methods.

UNIT –II: Production and Cost Analysis:

Production function - Law of Variable proportions - Isoquants and Isocosts -Law of returns - Economies of Scale - Cost Concepts - Fixed ,Variable Costs ,Explicit Costs , Implicit Costs & Opportunity cost - Cost Volume Profit Analysis - Break Even Point (Simple Problems)

UNIT -III: Market Structures & Pricing Policies:

Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly – Features – Price & Output Determination - Pricing Methods

UNIT -IV: Forms of Organizations & Business Cycles:

Business Organization- Sole Trader – Partnership - Joint Stock company - State/Public Enterprises and their forms - Business Cycles: Meaning and Features - Phases of Business Cycle.

UNIT - V: Introduction to Accounting:

Definition- Branches-Systems of Accounting-Single Entry- Double Entry System – Journal-Ledger- Trail Balance-Final Accounts (Simple problems)

UNIT - VI: Capital and Capital Budgeting:

Concept of Capital – Types -Sources of Capital-Long Term Sources-Equity, Preference and Debt Capital - Concept of Capital Budgeting-Cash Flow Estimation-Techniques of Capital Budgeting- Traditional and Modern Methods (Simple problems).

TEXT BOOKS:

1. Aryasri: Managerial Economics and Financial Analysis, 2/e, TMH, 2005.
2. T.V.Ramana & B. Kuberudu: Managerial Economics and Financial Analysis, Himalaya Publishing House, Mumbai
3. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2003.

REFERENCES:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 4th Ed.
3. Suma Damodaran, Managerial Economics, Oxford University Press.
4. Lipsey & Chrystal, Economics, Oxford University Press.
5. S. A. Siddiqui & A. S. Siddiqui, Managerial Economics & Financial Analysis, New age International Space Publications.
6. Domnick Salvatore: Managerial Economics In a Global Economy, 4th Edition, Thomson.
7. Narayanaswamy: Financial Accounting A Managerial Perspective, PHI.
8. Raghunatha Reddy & Narasimhachary: Managerial Economics & Financial Analysis, Scitech.
9. S.N.Maheswari & S.K. Maheswari, Financial Accounting, Vikas.

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JAVA PROGRAMMING				

UNIT I: Basics of Object Oriented Programming (OOP):

Introduction to OOPS: Paradigms of Programming Languages - Basic concepts of Object Oriented Programming – Differences between Procedure Oriented Programming and Object Oriented Programming - Objects and Classes – Data abstraction and Encapsulation, Inheritance, Polymorphism, Dynamic binding, Message communication – Benefits of OOP – Application of OOPs.

Introduction to Java : History – Java features – Java Environment – JDK1.7 – API, Creating and Executing a Java program – Java Tokens: Keywords, Character set, Identifiers, Literals, Comments in Java program Separator – Java Virtual Machine (JVM).

UNIT II: Java Basics:

Data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program, classes and objects – concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.

UNIT III: Inheritance:

Defining a subclass – Deriving a sub class – Single Inheritance – Multilevel Inheritance – Hierarchical Inheritance – Overriding methods – Final variables and methods – Final classes - Abstract methods and classes – Visibility Control: public access, private access, protected. Member access rules, super uses, polymorphism, abstract classes.

UNIT IV: Packages and Interfaces:

Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

UNIT V: Exception handling

Concepts of exception handling, benefits of exception handling, Termination or presumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes.

UNIT VI: Multithreading:

Creating Threads – Life Cycle of a Thread – Defining & Running Thread – Thread Methods – Thread Priority – Synchronization – Implementing run able interface – Thread Scheduling. Differences between multi threading and multitasking, daemon threads, thread groups.

TEXT BOOKS:

1. Java; the complete reference, 7th edition, Herbert Scheldt, TMH.
2. Java: How to Program, 8/e, Dietal, Dietal, PHI
3. Programming in JAVA, Sachin Malhotra, Saurabh choudhary, Oxford.
4. Introduction to Java programming 6th edition, Y. Daniel Liang, Pearson education.
5. Introduction to Java Programming, 7th ed, Y Daniel Liang, Pearson.

REFERENCES:

1. JAVA Programming, K.Rajkumar, Pearson.
2. Core JAVA, Black Book, Nageswara Rao, Wiley, Dream Tech.
3. Core JAVA for Beginners, Rashmi Kanta Das, Vikas.
4. Object Oriented Programming Through Java, P.Radha Krishna, Universities Press.
5. An Introduction to programming and OO design using Java, J.Nino and F.A. Hosch, John wiley & sons.

SEMESTER-III	L	T	P	C
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FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

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. Bernoulli's apparatus.

ADD ON EXPERIMENTS:

1. Metacenter height of a floating body.
2. Flow measuring by using Rota meter.

NOTE: Any 10 of the above 12 experiments are to be conducted.

SEMESTER-III	L	T	P	C
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ELECTRICAL AND ELECTRONICS ENGG. LAB				

1. Calibration and Testing of 1- Φ Energy Meter
2. Measurement of 3- Φ Reactive power with 1- Φ wattmeter
3. Measurement of Active Power for star and Delta connected balanced loads
4. Measurement of Reactive Power for star and Delta connected balanced loads
5. P-N junction Diode Characteristics
6. Zener Diode Characteristics
7. Transistor CE configuration characteristics
8. Full Wave Rectifier with and without Filters
9. Bipolar Junction Transistor characteristics
10. Field Effect Transistor Characteristics

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SOFTSKILLS/APTITUDE LAB-1

Reading comprehension: Reading Passage -1 (1 hour): Artificial Intelligence

Reading Passage – 2 (1 hour): Atmosphere

Reading Passage – 3 (1 hour): Modern Life

Reading Passage –4 (1 hour): Father of the Olympic Games

Speaking Skills :

Task-1- Self Introduction : (1 hour)

Task-2- Presentation skills : (1 hour)

Task-3- Group Discussion : (1 hour)

Task-4- Review of a Cinema : (1 hour)

Task-5- Just A Minute : (1 hour)

Task-6- Role Play : (1 hour)

Writing Skills :

Task-1- Letter writing - Formal (1 hour)

Task-2- Resume writing : (1 hour)

Task-3- Parallel writing : (1 hour)

Task-4- Story generating : (1 hour)

Task-5-Text Building : (1 hour)

Task-6-Diary writing : (1 hour)

Verbal Reasoning:

Task-1- Detection of errors (1 hour)

Task-2- Sentence corrections (1 hour)

Task-3- Insertions of apt words from the given confusionable words

Task-4-Scrambled words(1 hour)

Task-5- Dialogue completion(1 hour)

Task-6-Analogies (1 hour)

Task-7-Root words(1 hour)

Task-8-Synonyms(1 hour)

Task-9- Antonyms(1 hour)

Task-10- Odd one out (1hour)

Speed Mathematics

Think Without Ink(TWI) Approach - Speed Maths: Squaring of Numbers - Multiplication of Numbers - Finding Square Roots - Finding Cube Roots - Solving Simultaneous Equations Faster – Number

System: HCF, LCM - Decimals - Percentages - Averages - Powers and Roots - Sudoku (level 1) -Series Completion (Numbers, Alphabets, Pictures) - Odd Man Out - Puzzles

Verbal Reasoning

Analogies - Alphabet Test - Theme Detection - Family Tree - Blood Relations (Identifying relationships among group of people) - Coding & Decoding - Situation Reaction Test – Statement & Conclusions

REFERENCE BOOKS:

1. Instructional Manual- Prepared by Faculty.
2. Aggarwal, R.S. “A Modern Approach to Verbal and Non-verbal Reasoning”, Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.
3. Abhijit Guha, “Quantitative Aptitude”, TMH, 3rd edition.

SEMESTER-IV	L	T	P	C
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MECHANICS OF SOLDS				

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 module & the relationship between them – Bars of varying section – composite bars – thermal 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, Uniformly Distributed Load, 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 – Bending equation – Determination of bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle sections – Design of simple beam sections

UNIT IV

SHEAR STRESSES: Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

TORSION: Theory of simple torsion - Torsion of circular shafts, pure shear, transmission of power by circular shafts, Shafts in series, shafts in parallel.

UNIT V

DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay’s methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - Uniformly Distributed Load , Uniformly Varying Load. Mohr’s theorems – Moment area method – application to Simple cases.

UNIT VI

THIN CYLINDERS : Thin seamless cylindrical shells – Longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in cross section, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.

THICK CYLINDERS : lame's equation – cylinders subjected to internal and external pressures – compound cylinders.

TEXT BOOKS

1. Strength Of Materials – S. Ramamrutham/Dhanpat Rai Publications
2. Strength Of Materials – R.K. Rajput/S.Chand
3. Engineering mechanics of solids – E.P.Popov/Prentice Hall Publications

REFERENCES

1. Strength Of Materials –R.S Khurmi ,N.Khurmi/ S.Chand Publications
2. Strength Of Materials – Jindal/ Umesh Publications
3. Analysis Of Structures – Vazirani And Ratwani-kanna publications.

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IC ENGINES AND GAS TURBINES

UNIT – I:

ACTUAL CYCLES AND THEIR ANALYSIS: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

UNIT-II:

I.C. ENGINES :Classification - Working principles, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication, principle of wankle engine, principles of super charging and turbo charging

UNIT – III:

COMBUSTION IN S.I. ENGINES : Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types.

COMBUSTION IN C.I. ENGINES : Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

UNIT –IV:

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.

UNIT-V:

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, types of combustion chambers.

UNIT-VI:

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 propulsive 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. C. Engines / V. GANESAN- TMH
2. Gas Turbines – V.Ganesan -TMH

REFERENCE BOOKS

1. Thermal Engineering/ R.K. Rajput-Laxmi Publications
2. Thermal Engineering /Mahesh Rathore-TMH

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PRODUCTION TECHNOLOGY				

UNIT – I

CASTING: Steps involved in making a casting – Advantage of casting and its applications. – Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Principles of Gating, Gating ratio and design of Gating systems

UNIT – II**MELTING AND SOLIDIFICATION:**

Methods of melting: Crucible melting and cupola operation, steel making processes.

Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys. Risers – Types, function and design, casting design considerations, special casting processes 1) Centrifugal 2) Die, 3) Investment.

UNIT – III

WELDING: Classification of welding process types of welds and welded joints and their characteristics, design of welded joints, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding.

UNIT – IV**A) SPECIAL WELDING PROCESSES**

Inert Gas welding, TIG & MIG, welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering & Brazing. Heat affected zones in welding; welding defects – causes and remedies – destructive nondestructive testing of welds.

B) CUTTING OF METALS: Oxy – Acetylene Gas cutting, water plasma. Cutting of ferrous, non - ferrous metals.

UNIT – V

HOT & COLD WORKING: strain hardening, recovery, recrystallization and grain growth, Comparison of properties of Cold and Hot worked parts, Rolling fundamentals – theory of rolling, types of Rolling mills and products. Stamping, forming and other cold working processes : Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning – Types of presses and press tools.

UNIT- VI

EXTRUSION OF METALS: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion. **FORGING PROCESSES:** Principles of forging – Tools and dies – Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects. **PROCESSING OF PLASTICS:** Types of Plastics, Properties, applications and their Processing methods & Equipment (blow & injection modeling)

TEXT BOOKS:

1. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson Edu.
2. Manufacturing Technology / P.N. Rao/TMH

REFERENCES:

1. Production Technology / R.K. Jain /Khanna
2. Process and materials of manufacturing –Lindberg/PHI
3. Principles of Metal Castings / Roenthal.
4. Welding Process / Paramar / Tata MC Graw Hill
5. Production Technology /Sarma P C / S.Chand
6. Production Engineering – Suresh Dalela & Ravi Shankar / Galgotia Publications Pvt. Ltd.

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KINEMATICS OF MACHINERY				

UNIT I

INTRODUCTION TO MECHANISMS : Kinematic Elements or Links – Classification – kinematic pair, Kinematic Chain- Degrees of freedom , Grashoff's law , Kutzbach criterion for planar mechanisms.

MECHANISM AND MACHINES

Mechanism and machines – classification of machines – inversion of mechanism – inversions of quadric cycle, chain – single and double slider crank chains.

UNIT II

LOWER PAIR MECHANISMS : Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russel – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, Pantograph- Conditions for correct steering – Davis Steering gear, Ackermans steering gear – velocity ratio- **HOOKE'S JOINT** : Single and double Hooke's joint – Universal coupling – application.

UNIT III

KINEMATICS : Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain. Analysis of Mechanisms : Analysis of slider crank chain for displacement , velocity and acceleration of slider – Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration. Plane motion of body : Instantaneous center of rotation, centroids and axodes – relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for Simple mechanisms and determination of angular velocity of points and links.

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. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases. Analysis of motion of followers : Roller follower – circular cam with straight, concave and convex flanks.

UNIT V

GEARS : Higher pairs, friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact – Introduction to Helical, Bevel and worm gearing.

UNIT VI

POWER TRANSMISSION : Introduction, Belt and rope drives, selection of belt drive- types of belt drives, V-belts, materials used for belt and rope drives, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains- length, angular speed ratio, classification of chains.

GEAR TRAINS: Introduction – Train value – Types – Simple and reverted wheel train – Epicyclic gear Train. Methods of finding train value or velocity ratio – Epicyclic gear trains. Selection of gear box-Differential gear for an automobile

TEST BOOKS

1. Theory Of Machines - S.S Rattan-TMH
2. Mechanism And Machines Theory - Jagadish Lal
3. Theory Of Machines - Thomas Bevan / Cbs

REFERENCE

1. Theory Of Machines – R.K Bansal /Laxmi Publications (P)Ltd
2. The Theory Of Machines – Shiegley/ Oxford

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MACHINE DRAWING				

MACHINE DRAWING CONVENTIONS:

Need for drawing conventions – introduction to IS conventions

1. Conventional representation of materials, common machine elements and parts such as Screws, nuts, bolts, keys, gears, webs, ribs.
2. Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
3. Common abbreviations & their liberal usage

I. DRAWING OF MACHINE ELEMENTS AND SIMPLE PARTS

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

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

II. ASSEMBLY DRAWINGS:

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

1. **ENGINE PARTS**– stuffing boxes, cross heads, Eccentrics, Petrol Engine connecting rod, Piston assembly.
2. **OTHER MACHINE PARTS**- Screws jacks, Machine Vices Plummer block, Tailstock.
3. **VALVES**: Steam stop valve, spring loaded safety valve, feed check valve and air cock.

TEXT BOOKS:

1. Machine Drawing – K.L.Narayana, P.Kannaiah & K. Venkata Reddy / New Age/ Publishers
2. Machine Drawing –N.D Bhatt, V. M. Panchal/ Charotar Publishing House Pvt. Ltd

REFERENCES:

1. Machine Drawing – P.S.Gill.
2. Machine Drawing – Luzzader
3. Machine Drawing - Rajput

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PROBABILITY & STATISTICS				

Unit-I Probability: Sample spaces and events-probability –the axioms of probability-some elementary theorems – conditional probability – Baye’s theorem.

Unit-II Random variables: Introduction – random variables – discrete & continues and their applications - Distributions – Distributions Functions.

Unit-III Distributions: Discrete Distribution – binomial & Poisson distributions with their applications. Continuous distributions – normal and exponential distributions with their applications

Unit-IV Sampling distributions: Population and samples –sampling distributions of mean for large and small samples (with known and un-knowns variance) – Proportion sums and differences of means – sampling distributions of variance - point and interval estimators for means and proportions.

Unit-V Tests of Hypothesis: Introduction – Types I and II type II errors – Maximum error-One tail, twotail tests-Tests concerning one mean and proportion, two means-proportions and their differences using Z-test, Student’s t-test-F-test and Chi-square test.

Unit-VI Curve Fitting: Method of least squares -Fitting a straight line, Second degree parabola - exponential curve-power curves

TEXT BOOKS:

1. Probability and statistics by K. Murugesan and P.Gurusamy
2. Higher Engineering Mathematics by Dr. B.S.Grewal

REFERENCES:

- 1 Probability and Statistics for Engineers, By Miller & Freund’s

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PRODUCTION TECHNOLOGYLAB				

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

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MECHANICS OF SOLIDS & METALLURGY LAB				

ANY 6 EXPERIMENTS FROM EACH SECTION A AND B.

METALLURGY LAB:

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardenability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

MECHANICS OF SOLIDS LAB:

1. Direct tension test
2. Bending test on a) Simple supported b) Cantilever beam
3. Torsion test
4. Hardness test a) Brinells hardness test b) Rockwell hardness test
5. Test on springs .

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SOFTSKILLS/APTITUDE LAB-II				

TASK-I: SPEED MATHS, QUANTITATIVE APTITUDE

Think Without Ink(TWI) Approach - Speed Maths: Squaring of Numbers - Multiplication of Numbers - Finding Square Roots - Finding Cube Roots - Solving Simultaneous Equations Faster - Number System: HCF, LCM Decimals - Percentages - Averages - Powers and Roots - Sudoku (level 1) - Series Completion (Numbers, Alphabets, Pictures) - Odd Man Out - Puzzles

TASK-II: VERBAL REASONING

Analogies - Alphabet Test - Theme Detection - Family Tree - Blood Relations (Identifying relationships among group of people) - Coding & Decoding - Situation Reaction Test - Statement & Conclusions

TASK-III: QUANTITATIVE APTITUDE- PART-

Problem on Ages - Percentages - Profit and Loss - Simple & Compound Interest - Averages - Ratio, Proportion

TASK-IV: QUANTITATIVE APTITUDE – PART 2

Speed, Time & Work and Distance - Pipes and Cisterns - Mixtures and Allegations - Races - Problem on Trains - Boats and Streams **Practice** : Puzzles, Sudoku, Series Completion, Problem on Numbers

REFERENCE BOOKS:

1. Aggarwal, R.S. "A Modern Approach to Verbal and Non-verbal Reasoning", Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.
2. Abhijit Guha, "Quantitative Aptitude", TMH, 3rd edition

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DYNAMICS OF MACHINERY				

UNIT – I

PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships, static and dynamic force analysis of planar mechanisms.

UNIT – II**FRICITION-CLUTCHES**

FRICITION: Principles of friction, Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis.

CLUTCHES: Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch.

UNIT-III

BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, band brake of vehicle. Principle and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson.

UNIT – IV

TURNING MOMENT DIAGRAMS: Dynamic force analysis of slider crank mechanism, inertia torque, crank effort and turning moment diagrams – fluctuation of energy – fly wheels and their analysis.

GOVERNORS: Introduction, Centrifugal governor, Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs. sensitiveness, isochronism and hunting.

UNIT – V

BALANCING: Balancing of rotating masses single and multiple – single and different planes, use analytical and graphical methods.

BALANCING OF RECIPROCATING MASSES: Primary, secondary, and higher balancing of reciprocating masses. analytical and graphical methods, unbalanced forces and couples – examination of “V” multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing, hammer blow, swaying couple, variation of tractive effort.

UNIT – VI

VIBRATIONS: Free Vibration of spring mass system – oscillation of pendulums, centers of oscillation and suspension. Transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerly's methods, Raleigh's method, whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems, Simple problems on forced damped vibration, vibration isolation and transmissibility.

TEXT BOOKS:

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

REFERENCES:

1. Mechanism and Machine Theory - J.S. Rao and R.V. Dukkipati / New Age
2. Theory of Machines - Shiegly / MGH
3. Theory of Machines -Thomas Bevan / Pearson Publishers
4. Theory of machines - R.S. Khurmi & J.K.Guptha /S.Chand.

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DESIGN OF MACHINE ELEMENTS				

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.

DESIGN OF MACHINE ELEMENTS FOR STATIC LOADING: Simple stresses – Combined stresses – Torsional and bending stresses – impact stresses – Various theories of failure – Design for strength and rigidity – The concept of stiffness in tension, bending, torsion and combined situations – Static strength design based on fracture toughness.

UNIT – II**DESIGN OF MACHINE ELEMENTS FOR DYNAMIC LOADING:**

Stress concentration – Theoretical stress Concentration factor – Fatigue stress concentration factor notch sensitivity – Design for fluctuating stresses – Endurance limit – SN Curve-Estimation of Endurance strength – Goodman’s line – Soderberg’s line – Modified Goodman’s line.

UNIT – III

SHAFTS: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code. Use of internal and external circlips, Gaskets and seals (stationary & rotary).

UNIT – IV**KEYS, COTTERS AND KNUCKLE JOINTS:**

Design of Keys-stresses in keys-cottered joints-spigot and socket, sleeve and cotter, jib and cotter joints-Knuckle joints.

SHAFT COUPLING: Rigid couplings – Muff, Split muff and Flange couplings. Flexible couplings –Flange coupling (Modified).

UNIT – V

RIVETED AND WELDED JOINTS – Design of joints with initial stresses – eccentric loading .

Bolted joints – Design of bolts with pre-stresses – Design of joints under eccentric loading – locking devices– both of uniform strength, different seals

UNIT – VI**MECHANICAL SPRINGS:**

Stresses and deflections of helical springs – Extension -compression springs – Springs for fatigue loading – natural frequency of helical springs – Energy storage capacity – helical torsion springs – Co-axial springs, leaf springs.

TEXT BOOKS :

1. Machine Design - V.B.Bandari / TMH Publishers, New Delhi
2. Machine Design - R.S. khurmi, J.K.Guptha / S Chand publications
3. Machine Design - P.C. Sharma.,D.K. Agarwal / S.K.Kataria & Sons
4. Machine Design- S MD Jalaludin / AnuRadha Publishers
5. Design Data hand Book- PSG college of engineering,coimbattore

REFERENCES :

1. Design of Machine Elements - V.M. Faires / Macmillan
2. Machine design - Schaum Series / McGraw Hill Professional
3. Machine design - Pandya & shah / Charotar Publishing House Pvt. Limited.
4. Machine Design- Robert L. Natron / Pearson education, Inc

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THERMAL ENGINEERING				

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, concepts of heat of reaction, adiabatic flame temperature, stoichiometry, and flue gas analysis.

UNIT-II:

BOILERS : Classification – working principles of L.P & H.P boilers with sketches – mountings and accessories – working principles, boiler horse power, equivalent evaporation, efficiency and heat balance – draught, classification – height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught- induced and forced.

UNIT-III:

STEAM NOZZLES: Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis – assumptions -velocity of fluid at nozzle exit-Ideal and actual expansion in a nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape.

STEAM CONDENSERS: Requirements of steam condensing plant – classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump- cooling water requirement.

UNIT-IV:

STEAM TURBINES: Classification – impulse turbine; mechanical details – velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-Laval turbine - methods to reduce rotor speed-velocity compounding, pressure compounding and velocity & pressure compounding, velocity and pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine, 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.

UNIT – V:

COMPRESSORS:– Classification –positive displacement and roto dynamic machinery – Power producing and power absorbing machines, fan, blower and compressor – positive displacement and dynamic types – reciprocating and rotary types.

RECIPROCATING: Principle of operation, work required, Isothermal efficiency, volumetric efficiency and effect of clearance, stage compression, under cooling, saving of work, minimum work condition for stage compression.

UNIT VI:

ROTARY (POSITIVE DISPLACEMENT TYPE):Roots Blower, vane sealed compressor, Lysholm 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.

TEXT BOOKS

1. Thermodynamics and Heat Engines- R.Yadav / Central book depot.
2. Thermal Engineering- R.K. Rajput / Laxmi Publications

REFERENCE BOOKS

1. Thermal Engineering - R.S. Khurmi / S Chand publications
2. Thermal Engineering - Mahesh Rathore / TMH
3. Heat Engineering – V.P Vasandani and D.S Kumar/ Metropolitan Book Company, New Delhi

SEMESTER-V	L	T	P	C
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MACHINE TOOLS				

UNIT—I

FUNDAMENTALS OF METAL CUTTING: Elementary treatment of metal cutting theory – element of cutting process – geometry of single point tool 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, cutting tool materials.

UNIT—II

LATHE: Introduction principle of working, specification of lathe , types of lathe , work holders tool holders ,box tools taper turning, thread turning ,for lathes and attachments, turret and capstan lathes, collet chucks ,other work holders , tool holding devices , box and tool layout. Principal features of automatic lathe classification, single spindle and multi-spindle automatic lathes, tool layout and cam design.

UNIT—III

SHAPING, SLOTTING AND PLANNING MACHINES: Principles of working – principal parts – specifications, operations performed, machining time calculations.

GRINDING: Theory of grinding – classification of grinding machines, cylindrical and surface grinding machines, tool and cutter grinding machines, different types of abrasives, specification and selection of a grinding wheel. Lapping, Honing & Broaching operations, comparison to grinding.

UNIT – IV

MILLING MACHINE: Principles of working – specifications – classification of Milling Machines – principal features of horizontal, vertical and universal Milling Machine, machining operations, types of cutters, geometry of milling cutters – methods of indexing, accessories to milling machines.

UNIT – V

DRILLING & 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.

JIGS & FIXTURES: Principles of design of jigs and fixtures and uses, classification of jigs & fixtures, principles of location and clamping, types of clamping & work holding devices, typical examples of jigs and fixtures.

UNIT – VI

CNC MACHINE TOOLS: CNC Machines, working principle, classification, constructional features of CNC machines, CNC controller, types of motion controls in CNC machines, applications of CNC machines.

TEXT BOOKS:

1. Production Technology - R.K. Jain and S.C. Gupta / Khanna Publishers, New Delhi
2. Workshop Technology - Vol. - II - B. S. Raghuvamsi

REFERENCE BOOKS

1. Production technology by HMT publications
2. Metal cutting Principles - M.C. Shaw / CBS publications.

SEMESTER-V	L	T	P	C
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AUTOMOBILE ENGINEERING				

UNIT – I

INTRODUCTION : Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, turbo charging and super charging. Engine lubrication: splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft..

UNIT – II

FUEL SYSTEM IN S.I. ENGINES: Fuel supply systems, Mechanical and electrical fuel pump – filters– carburettor – types – air filters – petrol injection.

Fuel System in C.I. Engines: Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps.

UNIT – III

COOLING SYSTEM: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporating 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 – spark advance and retard mechanism.

UNIT – IV

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, construct 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.

UNIT – V

STEERING SYSTEM: Steering geometry – camber, castor, king pin rake, combined angle toe in, cent er point steering. Steering gears – types, Power Steering.

ELECTRICAL SYSTEM: Starting System- Bendix Drive Mechanism- Solenoid Switch- lighting System-Horn-Wiper.

UNIT – VI

SUSPENSION SYSTEM: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

BRAKING SYSTEM: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder, tandem master cylinder, Requirement of brake fluid, Pneumatic and vacuum brakes.

TEXT BOOKS:

1. Automotive Engineering Vol. 1 & Vol. 2 - Kirpal Singh / Standard Publications
2. Automobile Engineering - R.B .Gupta / Surya Prakash publications

REFERENCES:

1. Automobile Engineering- G. B. S. Narang / Khanna Publishers.
2. A Text book of Automobile Engineering- R.K.Rajput / Lakshmi Publications

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OPERATIONS RESEARCH				

UNIT - I

Definition— Characteristics and Phases — Types of models (iconic, analogy and symbolic or mathematical models) — applications.

Allocation: Linear Programming Problem Formulation — Graphical solution — Simplex method — Artificial variables techniques -Two—phase method, Big-M method — Duality Principle.

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

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 — Minimax (maximin) — Criterion and optimal strategy — Solution of games with saddle points — Rectangular games without saddle points — 2 X 2 games — dominance principle — in X 2 & 2 X n games -graphical method.

UNIT - V

Waiting L Ines: Introduction — Single Channel — Poisson arrivals — exponential service times — with infinite population and finite population models.

Inventory: Introduction — Single item — Deterministic models — Purchase inventory models with one price break and multiple price breaks — shortages are not allowed .

UNIT-VI

Simulation: Definition — Types of simulation models — phases of simulation— applications of simulation — Inventory and Queuing problems — Advantages and Disadvantages — Simulation Languages.

TEXT BOOKS:

1. Operation Research - S.D.Sharma / Ramnath co, Meerut.
2. Operation Research - P.K.Gupta, D.S.Hira / S.Chand.

REFERENCES:

1. Operation Research - A.M.Natarajan, P.Subrmani,A.T amilarasi.
2. Operation Research - R.Panneerselvem/PHI

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THERMAL ENGINEERING LAB				

1. I.C.Engines Valve /Port timing Diagrams.
2. Performance test on single cylinder four stroke Diesel engine.
3. Performance test on single cylinder four stroke Petrol engine.
4. Morse test on multi cylinder, four stroke Petrol engine.
5. Motoring test on single cylinder four stroke Petrol engine, and retardation test on single cylinder Diesel engine.
6. I.C.Engine heat balance on single cylinder four stroke Diesel engine.
7. Economical speed test on Single cylinder, four stroke Diesel engine.
8. Performance test on Multi cylinder four stroke Petrol Engine.
9. Performance test on Reciprocating Air –Compressor unit.
10. Study of Boilers.
11. Dis-assembly / Assembly of I.C.Engine.

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MACHINE TOOLS LAB				

1. Study of general purpose machines – lathe, drilling machine, milling machine, shaper, planing machine, slotting machine, cylindrical grinding, and Surface grinder.
2. Step and Taper turning on lathe machine.
3. Thread and Knurling on lathe machine.
4. Drilling and Tapping.
5. Shaping and Planning.
6. Slotting.
7. Milling.
8. Cylindrical surface grinding.

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METROLOGY				

UNIT – I**LIMITS AND FITS AND TOLERANCES:**

Introduction to Systems of limits and fits, normal size, tolerance & limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard Institution system – British standard system, International Standard system for plain and screw work.

UNIT – II**LINEAR MEASUREMENT:**

Length standard, line and end standard, slip gauges – calibration of the slip gauges, Dial indicator, micrometers.

MEASUREMENT OF ANGLES AND TAPERS:

Different methods – Bevel protractor – angle and slip gauges – spirit levels – sine bar – Sine table, rollers and spheres used to determine the tapers.

LIMIT GAUGES: Taylor's principle – Design of go and No go gauges, plug ring, snap, gap, taper, profile and position gauges.

UNIT – III

OPTICAL MEASURING INSTRUMENTS: Tool maker's microscope and its uses – autocollimators, 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.

UNIT – IV

SURFACE ROUGHNESS MEASUREMENT : Differences between surface roughness and surface waviness-Numerical assessment of surface finish – CLA,R, R.M.S Values – Rz values, Rz value, Methods of measurement of surface finish-profilograph. Talysurf, ISI symbols for indication of surface finish.

MEASUREMENT THROUGH COMPARATORS: Comparators – Mechanical, Electrical and Electronic Comparators, pneumatic comparators and their uses in mass production.

UNIT-V

SCREW THREAD MEASUREMENT: Element of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread (two wires and three wires) pitch, profile thread gauges.

UNIT- VI

GEAR MEASUREMENT: Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch pressure angle and tooth thickness. Coordinate Measuring Machines: Types of CMM, Role of CMM, and Applications of CMM.

TEXT BOOKS:

1. Engineering Metrology / I C Gupta/ Danpath Rai publications.
2. Engineering Metrology / R.K. Jain / Khanna Publishers.

REFERENCES:

1. BIS standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
2. Fundamentals of Dimensional Metrology 4e / Connie Dotson / Thomson.
3. Engineering Metrology / mahajan/ Danpath Rai.
4. Precision engineering in manufacturing by R.L.Murthy/New age.

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HEAT TRANSFER				

UNIT – I

INTRODUCTION: Modes and mechanisms of heat transfer – Basic laws of heat transfer, applications of heat transfer

CONDUCTION HEAT TRANSFER: General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates. 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 – overall heat transfer coefficient – electrical analogy – Critical radius of insulation. Systems with Heat generation. Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin.

ONE DIMENSIONAL TRANSIENT CONDUCTION HEAT TRANSFER: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers - Chart solutions of transient conduction systems.

UNIT-III

CONVECTIVE HEAT TRANSFER: Classification of convective heat transfer - dimensional analysis – Buckingham Pi Theorem for forced and free convection, Significance of non-dimensional numbers ~ concepts of continuity, momentum and Energy Equations.

FORCED CONVECTION:

EXTERNAL FLOWS: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer - Flat plates and Cylinders.

INTERNAL FLOWS: Concepts about Hydrodynamic and Thermal Entry Lengths - Use of empirical relations for Horizontal Pipe Flow and annulus flow.

FREE CONVECTION: Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for Vertical plates and pipes.

UNIT-IV**HEAT TRANSFER WITH PHASE CHANGE:**

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

CONDENSATION: Film wise and drop wise condensation - Film condensation on vertical and horizontal cylinders using empirical correlations.

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.

UNIT-VI**RADIATION HEAT TRANSFER:**

Emission characteristics and laws of black-body radiation – Irradiation– laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between greybodies, radiation shields.

TEXT BOOKS :

1. Fundamentals of Engg. Heat and Mass Transfer - R.C.Sachdeva / New Age International.
2. Heat Transfer – P.K.Nag/ TMH.
3. Heat Transfer – S.P.Sukhatme/ University Press.

REFERENCE BOOKS:

1. Heat Transfer / HOLMAN/TMH
2. Heat and Mass Transfer –Cengel / McGraw Hill.
3. Heat and Mass Transfer – R.K. Rajput / S.Chand& Company Ltd.
4. Heat and Mass Transfer – D.S.Kumar / S.K.Kataria& Sons.
5. Heat Transfer –Ramakrishna & P.C. Sharma / New Age Publications.

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DESIGN OF MECHANICAL TRANSMISSION SYSTEMS				

UNIT – I

BEARINGS : Types of Journal bearings – Lubrication – Bearing Modulus – Full and partial bearings – Clearance ratio – Heat dissipation of bearings, bearing materials – journal bearing design – Ball and roller bearings – Static and dynamic loading capacity of ball & roller bearings, Bearing life.

UNIT – II

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.

UNIT –III

Pistons, Forces acting on piston – Construction, Design and proportions of piston. Cylinder, Cylinder liners, piston rings.

UNIT – IV

DESIGN OF CURVED BEAMS: introduction, stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section. Design of crane hooks, C – clamps.

UNIT – V

BELT, ROPE AND CHAIN DRIVES: Transmission of power by Belt and Rope drives,

Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives, Materials, Chain drives(chain selection, no. of teeth, sprocket diameters...etc)

UNIT – VI

SPUR & HELICAL GEAR DRIVES: Spur gears- Helical gears – Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of spur gears – Estimation of centre distance, module and face width, check for plastic deformation. Check for dynamic and wear considerations.

TEXT BOOK:

1. Machine Design - V.Bandari /TMH Publishers.
2. Machine Design - Kannaiah/ Sciotech.

REFERENCES:

1. Design Data hand Book- S MD Jalaludin / Anuradha Publishers.
2. Machine Design / R.N. Norton.
3. Data Books : (I) P.S.G. College of Technology (ii) Mahadevan.
4. Mech. Engg. Design / JE Shigley.
5. Machine Design, S MD Jalaludin / Anuradha Publishers.
6. Machine Design by R.S. Khurmi and JS Gupta / S Chand publications.

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ROBOTICS				

UNIT - I

INTRODUCTION: Automation and Robotics, over view of Robotics, present and future applications, classification of robots.

UNIT-II

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, types, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT – III

MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation, problems.

MANIPULATOR KINEMATICS: D-H Notations, joint coordinates and world coordinates, Forward and inverse kinematics, problems of simple robotic manipulator.

UNIT - IV

MANIPULATOR DYNAMICS: Differential transformation of manipulators, Jacobians, problems.

Dynamics: Lagrange, Euler and Newton, Euler formulations, Problems.

TRAJECTORY PLANNING: Path Planning, Skew motion, joint integrated motion, straight line motion.

ROBOT PROGRAMMING: languages and software packages.

UNIT - V

ROBOT ACTUATORS AND FEEDBACK COMPONENTS: Actuators: Pneumatic, Hydraulic actuators, electric and stepper motors. Feedback components: Position Sensors, Potentiometers, Resolvers, Encoders, Velocity sensors.

UNIT – VI

ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer, Material handling, loading and unloading, Processing: Spot and Continuous Arc Welding & Spray Painting, Assembly and Inspection.

TEXT BOOKS:

1. M. P. Groover (2010), Industrial Robotics, 3rd edition / Pearson Education, New Delhi.
2. K.S. Fu (2010), Robotics, control Sensing , vision and intelligence, 1 st edition / Tata Mc Graw Hill Publishing Company Ltd., New Delhi.

REFERENCE BOOKS:

1. R.K. Mittal, I. J. Nagrath (2012), Robotics and Control, 1st edition / Tata Mc Graw Hill Publishing Company Ltd., New Delhi.

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INDUSTRIAL ENGINEERING MANAGEMENT				

UNIT - I

MANAGEMENT SCIENCE: Basic concepts of Management, Contribution of Taylor and Fayol to Scientific Management, Motivation and Control, Maslow's hierarch of needs, Leadership styles, Managerial Grid.

UNIT - II

WORK STUDY: Introduction, Techniques of work study, Method study- procedure, recording techniques, Principles of motion economy, Micro-motion analysis, Work measurement – Time study, work/activity sampling, Predetermined motion time standards, Job evaluation and Merit rating- Procedure and Methods.

UNIT - III

PLANT LOCATION: Importance and factors affecting plant location, Single and Multi facility plant location problems.

PLANT LAYOUT: Need, Importance, Objectives and Principles of good plant layout, Types of layout and applications.

UNIT-IV

MATERIAL HANDLING: Objectives, functions, principles of material handling, Types of material handling equipment and selection.

UNIT - V

MATERIALS MANAGEMENT: Objectives, Inventory control- Purpose, types, functions, basic EOQ, safety stock inventory control systems, selective control of inventory ABC and VED analysis, Inventory control system-periodic review system, Store Management and stores record, purchase management.

UNIT - VI

INSPECTION AND QUALITY CONTROL: Types of Inspections, Statistical Quality Control techniques, acceptance sampling plan, Introduction to Total Quality Management, Quality Circles, ISO 9000 series procedures.

TEXT BOOK:

1. Khanna O.P., Industrial Engineering and Management, Khanna Publishers, New Delhi, 1999.

REFERENCES

1. Amrine, H.T., Ritchey, J.A., Moodie, C.L., & Kmec, J.F., Manufacturing Organization and Management, Pearson Education, 2nd Edition, 2004.
2. James M. Apple, Principles of Layout and Material Handling, Ronald press, 1997.
3. Maynard, H., Industrial Engineering Hand Book, McGraw Hill Book Co., New York, 1999.
4. Kanawaty, G., Introduction to work study, International Labour Office, 4th Edition, Geneva, 1992.
5. Fiegenbarum, A.V., Total Quality Control, McGraw Hill Inc., 1991.

SEMESTER-VI	L	T	P	C
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METROLOGY LAB				

List of Experiments

1. Measurement of lengths, heights, diameters by Vernier callipers, micrometers etc
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth Vernier callipers and checking the chordal thickness.
4. Machine tool alignment test on lathe.
5. Machine tool alignment test on milling machine.
6. Angle and taper measurements by Bevel protractor, Sine bar.
7. Use of spirit level in finding the straightness of a bed and a surface.
8. Thread measurement by two wire/ three wire microscope.
9. Surface roughness measurement by Talysurf.

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HEAT TRANSFER LAB				

List of Experiments

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere.
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin.
6. Heat transfer in forced convection apparatus.
7. Heat transfer in natural convection.
8. Parallel and counter flow heat exchanger.
9. Emissivity apparatus.
10. Stefan Boltzman Apparatus.
11. Critical Heat flux apparatus.
12. Study of Heat Pipe.

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MECHANICAL VIBRATIONS				

UNIT-I**HARMONICALLY EXCITED VIBRATION:**

Introduction, equation of motion, response of an undamped system under harmonic force, response of a damped system under the harmonic motion of the base, response of a damped system under rotating unbalance, forced vibration with coulomb and hysteresis damping.

UNIT-II**TWO DEGREES OF FREEDOM SYSTEMS:**

Introduction, equations of motion for forced vibration, free vibration analysis of an undamped system, torsional system, coordinate coupling and principal coordinates, forced vibration analysis.

UNIT-III**MULTI DEGREE OF FREEDOM SYSTEMS:**

Introduction, modelling of continuous systems as multi degree of freedom systems, influence coefficients, potential and kinetic energy expressions in matrix form, generalized coordinates and generalized forces, using Lagrange's equation to derive equations of motion, equations of motion of undamped systems in matrix form, eigen value problem, solution of the eigen value problem, free vibration of undamped systems, forced vibrations of undamped systems using modal analysis, forced vibration of viscously damped system.

UNIT-IV**NONLINEAR VIBRATIONS:**

Introduction, examples of non linear vibration problems, exact methods, approximate analytical methods, sub harmonic and super harmonic oscillations, systems with time dependent coefficients, graphical methods, stability of equilibrium states, limit cycles, chaos.

UNIT-V**VIBRATION CONTROL:**

Introduction, vibration nomograph and vibration criteria, reduction of vibration at the source, balancing of rotating machines, whirling of rotating shafts, balancing of reciprocating engines, control of vibration, control of natural frequencies, introduction of damping, vibration isolation, vibration absorbers.

UNIT – VI

CRITICAL SPEEDS OF SHAFTS: Critical speeds without and with damping, secondary critical speed.

VIBRATION MEASURING INSTRUMENTS: Vibrometers, velocity meters and accelerometers

TEXT BOOKS

1. Mechanical Vibrations : G K Grover, Nem Chand & Bros., Roorkee,1996.
2. Rao S.S., “*Mechanical Vibrations*”, 4th Edition, Pearson Education, Inc., 2004.
3. Theory and Practice of mechanical vibrations : J S Rao & K Gupta, New age International (Pvt) Ltd., N Delhi, 2006, Ed.1 .

REFERENCES

1. Mechanical Vibrations : V P Singh, Dhanpat Rai & Sons, Delhi, 3rd edition, 2006. MEC 651 - Mechanical Vibrations L T P.
2. William T Thomson & Marie Dillon Dahleh, “*Theory of Vibrations with application*”, 5th Edition, Pearson Education Publication, 2007.
3. Tse, Morse and Hinkel, “*Mechanical Vibrations*”, Chapman and Hall, 1991.
4. Den Hartong J.P., “*Mechanical Vibrations*”, McGraw Hill, 1986.

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UN-CONVENTIONAL MACHINING PROCESS				

UNIT - I

INTRODUCTION: Need for non-traditional machining methods-Classification of modern machining processes, considerations in process selection, Materials, Applications.

UNIT - II

ULTRASONIC MACHINING: Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development. Abrasive jet machining, Water jet machining and abrasive water jet machine: Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations.

UNIT - III

ELECTRO CHEMICAL PROCESSES: Fundamentals of electro chemical machining, electrochemical grinding, electrochemical honing and deburring process. Metal removal rate in ECM, Tool design, Surface finish and accuracy economic aspects of ECM, Simple problems for estimation of metal removal rate, Fundamentals of chemical machining, advantages and applications.

UNIT - IV

EDM : General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes, Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

UNIT - V

EBM: Theory of electron beam machining, comparison of thermal and non-thermal processes, General Principle and application of laser beam machining -thermal features, cutting speed and accuracy of cut.

UNIT-VI

PLASMA ARC MACHINING:

Principle, Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

TEXT BOOKS:

1. P. C. Pandey, H. S. Shah (2012), *Modern machining process*, 1st edition, Tata McGraw- Hill Publishing Company Ltd., New Delhi.

REFERENCE BOOKS:

1. V. K. Jain (2008), *Advanced machining processes*, 3rd edition, Allied Publishers, New Delhi.

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POWER PLANT ENGINEERING				

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 equipment's, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

UNIT II

STEAM POWER PLANT: 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 – III

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.

UNIT IV

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.

UNIT – V

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 – VI

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 BOOK :

1. A Text Book of Power Plant Engineering / Rajput / Laxmi Publications.
2. Power Plant Engineering – P.C.Sharma / S.K.Kataria Pub.

REFERENCES :

1. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
2. A Course in Power Plant Engineering: / Arora and S. Domkundwar.
3. Power plant Engineering/ Ramalingam/ Scietech Publishers.
4. An Introduction to Power Plant Technology / G.D. Rai.

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DATA BASE MANAGEMENT SYSTEMS				

UNIT-I

Overview of DBMS, What is Data, Information?, Where can be used?, File vs. DBMS, View of Data, Data Abstraction, Instances and Schema, Types of Models, Database Languages for DDL and DML, Transaction Management, Structure Storage of DBMS, Query Processor.

UNIT-II

Overview of Database Design, How it works of Design Models?, ER Design Entities, Attributes and Entity Sets, Relationships and Relationship sets, Features of ER Model, Conceptual Design of ER Models.

UNIT-III

Overview of Relational Model, Constraints and Types, Querying in Relational Data, Logical Database Design, Views and its operations, Form of Basic SQL Query and Queries, Nested Queries, Correlated Nested Queries Set, Comparison Operators, Aggregative Operators, Logical Connectivity Operators, Joins and Types.

UNIT-IV

Schema Refinement, Problems Caused by Redundancy, What is Decomposition?, Problem Related to Decomposition, Normalizations and Types, Overview of Transaction, Transaction State, implementation of Atomicity and Durability, Concurrent Execution, Serializability, Recoverability.

UNIT –V

Lock based Protocols and Types, Overview of Recovery and Atomicity, Recovery with concurrent transactions, Buffer Management, Failure with loss of nonvolatile storage.

UNIT-VI

Data on External Storage, File Organization and Types, Indexing and Types, Comparison of File Organizations and Indexing, Indexes and Performance Tuning, B+Trees: A Dynamic Index Structures.

TEXT BOOKS:

1. Database Management Systems- Raghurama Krishnan, Johannes Gehrke, Tata McGraw-Hill, 3rd Edition.
2. Database System Concepts, Silberschatz, Korth, McGraw hill, V edition.

REFERENCES:

1. Database System Design, Implementation and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate Pearson Education.
3. Introduction to Database Systems, C.J.Date Pearson

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CAD/CAM

UNIT—I**INTRODUCTION AND COMPUTER GRAPHICS**

Computers in Industrial Manufacturing, Product life cycle, CAD/CAM Hardware Basic structure, CPU Memory Types, Input Devices, Display Devices, Hard copy Devices, and Storage Devices. Raster scan graphics coordinate system, Data base structure for graphics modelling, Transformation of geometry, 3D Transformations, Mathematics of projections, Clipping, Hidden surface removal.

UNIT – II**GEOMETRIC MODELING**

Requirements of GM, Geometric models, Geometric construction Models, Curve Representation Methods, Surface Representation Methods, Modelling Facilities Desired.

UNIT – III**DRAFTING AND MODELING SYSTEMS & PART PROGRAMMING FOR NC MACHINES**

Basic Geometric commands, Layers, Display control commands, Editing, Dimensioning, Solid Modeling NC, NC Modes, NC Elements, NC Machine Tools, Features of Machining Centre & Turning Centre, Fundamentals of manual part Programming Methods, Computer Aided Part Programming.

UNIT – IV**GROUP TECHNOLOGY**

Group Technology, Part family, coding Classification, Production flow Analysis, Advantages & Limitations, Computer Aided process planning, Retrieval type & Generative type.

UNIT – V**COMPUTER AIDED QUALITY CONTROL**

Terminology in QC, The Computer in QC, Contact inspection methods, Non contact IM, Non optical IM, Computer aided testing, Integration of CAQC with CAD/CAM.

UNIT – VI**COMPUTER INTEGRATED AND MANUFACTURING SYSTEMS**

Types of manufacturing systems, Machine Tools & Related Equipment, Material Handling Systems, Computer control systems, Human labor, CIMS Benefits.

TEXT BOOKS

1. CAD/CAM - P.N.RAO /McGraw Hill Education (India) Private Limited.
2. CAD/CAM --- A Zimmer's & P.Groover/PE/PHI.

REFERENCE BOOKS:

1. Automation, Production systems& Computer Integrated Manufacturing- Mikell P Groover / Pearson Education.
2. Principles of computer aided design and manufacturing - Farid Amirouche/ Pearson.
3. Computer Numerical Control Concepts and programming - warren s seames/ Thomson Learning.

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INSTRUMENTATION AND CONTROL SYSTEMS					

FUNDAMENTALS OF INSTRUMENTATION:

Definition - Basic principles of measurement - measurement systems, generalized configuration and functional description of measuring instruments – examples. Dynamic performance characteristics - sources of error, classification and elimination of error.

UNIT-II

MEASUREMENT OF DISPLACEMENT: Theory and construction of various transducers to measure displacement - Piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers.

MEASUREMENT OF TEMPERATURE: Classification - ranges – various principles of measurement-

Expansion, Electrical resistance: Thermistor - Thermocouple - Pyrometers - Temperature indicators.

UNIT-III

MEASUREMENT OF PRESSURE: Units - classification - different principles used, manometers, Dead Weight Piston, Bourdon pressure gauges, Bellows - Diaphragm gauges. Low pressure measurement - Thermal conductivity gauges – Ionization pressure gauges, McLeod pressure gauge.

UNIT-IV

MEASUREMENT OF LEVEL: Direct method - Indirect methods - Capacitative, Ultrasonic, Magnetic, Bubbler level indicators

FLOW MEASUREMENT: Rotameter, Magnetic, Ultrasonic, Turbine flow meter, Hot-wire anemometer, laser Doppler anemometer (LDA).

UNIT-V

MEASUREMENT OF SPEED: Mechanical tachometers – electrical tachometers - stroboscope, noncontact type of tachometer. Different simple instruments - principles of seismic instruments - vibrometer and accelerometer using this principle.

STRESS STRAIN MEASUREMENTS: Various types of stress and strain measurements - electrical strain gauge - gauge factor - method of usage of resistance strain gauge for bending compressive strains - usage for measuring torque.

MEASUREMENT OF FORCE, TORQUE AND POWER: Elastic force meters, load cells torsion meters, and dynamometers.

UNIT-VI

MEASUREMENT OF HUMIDITY - Moisture content of gases, Sling psychrometer, Absorption psychrometer, Dew point meter. Elastic force meters, load cells, torsion meters, dynamometers.

ELEMENTS OF CONTROL SYSTEMS: Introduction, importance -classification - open and closed systems servomechanisms - examples with block diagrams-temperature, speed & position control systems.

TEXT BOOKS:

1. Measurement Systems: Applications & design by D.S Kumar/ Khanna Publishers.
2. Instrumentation, measurement & analysis by B.C_Nakra & K.K.Choudhary, TMH.

REFERENCE BOOKS:

1. Measurement systems: Application and design, Doebelin Earnest. O.Adaptation by Manik and Dhanesh/ TMH.
2. Experimental Methods for Engineers/ Holman. McGraw-Hill Education.
3. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.
4. Mechanical Measurements/ Beck With, Marangoni, Linehard, PHI / PE.

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FINITE ELEMENT METHODS				

UNIT – I

INTRODUCTION TO FEM: Basic concept, historical background, application of FEM, general description, comparison of FEM with other methods. Basic equations of elasticity, Stress, strain relations, Strain Displacement relations.

UNIT-II

ONE DIMENSIONAL PROBLEM: Finite element modeling coordinates and shape functions. Potential Energy approach: formulation and assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions using elimination and penalty approaches.

UNIT - III

ANALYSIS OF TRUSSES: Stiffness Matrix for plane truss and space truss elements, assembly consideration, calculations of displacement and reactions.

ANALYSIS OF BEAMS: Hermite shape functions-Element stiffness matrix for simple beam element, load vector, calculations of displacement and stresses. .

UNIT - IV

2-D PROBLEMS: CST-Stiffness matrix and load vectors, Isoperimetric element representation, Shape functions, convergence requirements, Problems. Isoperimetric quadrilateral elements and numerical integration.

UNIT - V

STEADY STATE HEAT TRANSFER ANALYSIS: one dimensional analysis of a fins, one and two dimensional analysis of conduction in plates with convective boundary conditions.

UNIT – VI

DYNAMIC ANALYSIS: Formulation of finite element model, element matrices, Lumped and consistent mass matrices evaluation of Eigen values and Eigen vectors for a stepped bar and a beam.

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering- R. Tirupathi Chandrapatla / Pearson Education, India.
2. Finite element method - DARYL L.LOGAN/CENGAGE learning.

REFERENCE BOOKS:

1. Finite elements methods, 1st edition - Chennakesava R. Alavala / Prentice Hall of India publishers, New Delhi, India.
2. The Finite Element Methods in Engineering - S. S. Rao , 5th edition, Elsevier, USA.
3. Fundamentals of finite elements analysis - V. David. Hutton, 1st edition / Tata McGraw-Hill education (P) Ltd, New Delhi, India.

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REFRIGERATION AND AIRCONDITIONING				

UNIT - I

FUNDAMENTALS OF REFRIGERATION: Introduction- Necessity and applications, unit of refrigeration and C.O.P-Heat Engine, Refrigerator and Heat pump-Types of Refrigeration systems.

AIR REFRIGERATION SYSTEM: Introduction-Air refrigeration system working on Reversed Carnot cycle – Air refrigeration system working on Bell Coleman cycle- COP- Open and Dense air systems.

UNIT - II

VAPOUR COMPRESSION REFRIGERATION SYSTEM: Working principle-Simple Vapour Compression Refrigeration cycle – COP- Representation of cycle on T-s and P-h charts- Effect of Sub cooling and Superheating --Actual Vapor compression cycle

REFRIGERANTS: Classification of refrigerants- Desirable properties-Nomenclature-Commonly used refrigerants- Alternate refrigerants.

UNIT-III

VCR SYSTEM COMPONENTS: Compressors-Classification-Working -Condensers –Classification-Working-Evaporators –Classification-Working, Expansion devices –Types-Working.

UNIT - IV

VAPOUR ABSORPTION REFRIGERATION SYSTEM: Description and working of Aqua-Ammonia system-Calculation of maximum COP- Lithium Bromide- Water system-Principle of operation of Three fluid absorption system.

STEAM JET REFRIGERATION SYSTEM: Principle of working –Analysis- Applications.

UNIT - V

PSYCHROMETRY: Introduction - Psychrometric properties and relations- Psychrometric chart Psychrometric processes-Sensible, Latent and Total heat–Sensible Heat Factor and Bypass Factor-

HUMAN COMFORT: Thermodynamics of Human body-Effective temperature – Comfort chart.

UNIT – VI

AIR CONDITIONING SYSTEMS: Introduction-Components of Air conditioning system- Classification of Air conditioning systems-Central and Unitary systems- Summer, Winter and Year round systems-Cooling load estimation.

DESIGN OF AIR CONDITION SYSTEMS: Summer air conditioning –ADP-System with Ventilated and re-circulated air with and without bypass factor- RSHF, GSHF and ESHF.

NOTE: Refrigerants &Psychrometric properties- by M.L. Mathur& F.S. Mehta data book must be supplied in the exam hall.

TEXT BOOKS

1. Refrigeration and air conditioning - C. P. Arora. / TMH.
2. Principles of Refrigeration - R. Dossat / Pearson Education.
3. Refrigeration and Air Conditioning – Arora & Ramesh Chandra / PHI.

REFERENCES

1. A course in refrigeration and air conditioning - S. C. Arora, Domkundwar / DhanapatRai.
2. Refrigeration and Air conditioning - Manohar Prasad / TMH.
3. Refrigeration and Air conditioning – R.S.Khurmi / New Age Publications.

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CAD/CAM LAB				

LIST OF EXPERIMENTS

Any of the 10 Experiments are required to be conducted

1. PART MODELING: Generation of various 3D models through Protrusion, revolve, blend and sweep. Assemble Modeling for machine components.
2. Determination of deflection and stresses in beams.
3. Determination of deflection and stresses in 2D trusses
4. Analysis of deflection and stresses in plane stress, plane strain components.
5. Determination of deflection and stresses in Axis-symmetric components.
6. Determination of stresses in 3D structures.
7. Determination of natural frequencies, mode shapes and Harmonic response on 2D beam.
8. Steady state heat transfer Analysis of 2D and Axi -symmetric components.
9. Machining of simple components on NC lathe.
10. Machining of simple components on NC Mill.
11. Machining of simple components by using flexible manufacturing systems.

Packages to be provided to cater to drafting, modeling and analysis form the following.
AUTO CAD, Pro –E, ANSYS etc.

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INSTRUMENTATION AND CONTROL SYSTEMS LAB				

LIST OF EXPERIMENTS

1. Calibration of transducer for temperature measurement.
2. Study and calibration of LVDT transducer for displacement measurement.
3. Calibration of strain gauge.
4. Calibration of thermocouple.
5. Calibration of capacitive transducer.
6. Study and calibration of photo and magnetic speed pickups.
7. Calibration of resistance temperature detector.
8. Study and calibration of a rotameter.
9. Study and use of a seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
10. Study and calibration of Mcleod gauge for low pressure.

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ALTERNATIVE SOURCES OF ENERGY				

UNIT – I

PRINCIPLES OF SOLAR RADIATION : Role and potential of new and renewable sources, 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, solar azimuth angle, zenith angle, attitude angle, 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.

UNIT-III

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT-IV

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

UNIT-V

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.

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the geothermal energy, potential in India

UNIT-VI

ELECTROCHEMICAL EFFECTS AND FUEL CELLS: Principle of operation of an acidic fuel cell classification of fuel cells- other types of fuel cells- comparison between acidic and alkaline hydrogen oxygen fuel cells- efficiency and EMF of fuel cells- operating characteristics of fuel cells- advantages of fuel cell power plants future potential of fuel cells.

TEXT BOOKS:

1. Renewable energy resources - G.N.Tiwari & M.K. Ghosal / Alpha Science International Ltd.
2. Non-Conventional Energy Sources - G.D. Rai / khanna publishers.

REFERENCES:

1. Renewable Energy Sources - Twidell & Weir / Taylor & Francis, Publications.
2. Solar Energy - Sukhame/ Tata McGraw Hill publishing Co. Ltd.
3. Solar Power Engineering - B.S Magal Frank Kreith & J.F Kreith/ Standard Publishers & Distributors.
4. Principles of Solar Energy - Frank Kreith & John F Kreider./ Tata McGraw Hill publishing Co.Ltd.
5. Non-Conventional Energy - Ashok V Desai / Wiley Eastern Ltd.
6. Non-Conventional Energy Systems - K Mittal /Wheeler .
7. Renewable Energy Technologies - Ramesh & Kumar /Narosa

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INDUSTRIAL TRIBOLOGY				

UNIT - I

FRICITION: Types of friction, Theories of friction, Study of current concepts of boundary friction and dry friction, friction reducing measures.

UNIT - II

Wear Causes of wear, Types of wear, Mechanism of various types of wear, laws of wear, effects of wear

UNIT - III

VISCOSITY AND LUBRICANTS: Viscosity, flow of fluids, viscosity and its variation -absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used, Viscosity standards, Lubricants and their physical properties, Various theories of lubrication

UNIT - IV

THEORY OF HYDRODYNAMIC LUBRICATION: Petroff's equation, Reynold's equation in two dimensions, bearing modulus, Sommerfeld number, Effects of side leakage, pressure, flow, Load capacity and friction calculations, heat balance, minimum oil film thickness, oil whip and whirl.

UNIT - V

THEORY OF HYDROSTATIC LUBRICATION: Hydrostatic step bearing, pivoted pad thrust bearing, hydrostatic lifts, hydrostatic squeeze films, pressure, flow, load capacity and friction calculations, oil rings, pressure feed bearing, partial bearings, externally pressurized bearings, Air lubricated bearing, Advantages and disadvantages.

UNIT - VI

ANTI-FRICTION BEARINGS AND BEARING MATERIALS : Anti-friction bearings, types, Advantages and disadvantages, General requirements of bearing materials, types of bearing materials, General bearing design considerations.

TEXT BOOKS:

1. Fundamentals of Tribology - Basu, SenGupta and Ahuja/PHI.

REFERENCES:

1. Tribology in Industry - Sushil Kumar Srivatsava / S. Chand &Co.
2. Tribology – B.C. Majumdar / S Chand Publications.
3. Friction and Wear of materials – Rabinowicz / John Willey & Sons.
4. Principles of Tribology - Halling. J / Macmillan. Audio Book Publishing.
5. Engineering Tribology - Williams .J.A / Oxford University Press.

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INTERACTIVE COMPUTER GRAPHICS				

UNIT—I

INTRODUCTION: Application areas of Computer graphics, overview of graphic system, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations, introduction to PHIGS &GKS and input devices, input device handling algorithms

UNIT-- II

OUTPUT PRIMITIVES: Points and lines, line drawing algorithms, mid-point circle algorithm, Filled area primitives: scan-line polygon fill algorithm, boundary-fill and flood-fill algorithm

2-D VIEWING : The viewing pipe-line, viewing coordinate reference frame, window to view-port coordinate transformations, viewing function, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland- Hodgeman polygon clipping algorithm, segments

UNIT -- III

REPRESENTATION OF CURVES AND SURFACES: Spline representation, Hermite curve, Bezier curve and Bspline curve, Polygon surfaces, quadric surfaces, Solid modeling – wire frame, CSG, B-rep. Bezier and Bspline surfaces

UNIT – IV

Illumination: Basic illumination models, Light sources, diffuse reflection Lambert's cosine law and point source illumination, Specular reflection, Transparency and shadows. Shading algorithms: Constant intensity algorithm, Phong's shading algorithm, Gouraud shading algorithm, Comparison of shading algorithms. Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting.

UNIT – V

COMPUTER ANIMATION: Design of animation sequence, general computer animation functions, raster animation, computer animation language, key frame system, motion specification.

UNIT-VI

MULTI-MEDIA : Introduction: Multimedia Systems, Technology, Architecture, Hardware trade-offs, contents, PC, Applications, Data compressions, Authoring System

MULTIMEDIA AUTHORING TOOLS: Introduction, types of authoring tools, page based/In card authoring tools, icon-based authoring tools, Time-based and presentation tools, Object-oriented authoring tools. author ware professional for windows (APW).

TEXT BOOKS:

1. Computer Graphics C version - Donald Hearn and M. Pauline Baker, Pearson / PHI.
2. Computer Graphics Principles & practice, second edition in C - Foley, VanDam, Feiner and Hughes / Pearson Education.

REFERENCE BOOKS:

1. Computer graphics a practical approach - Er. Rajiv Chopra / S.chand Publications.
2. Computer Graphics Second edition - Zhigand xiang, Roy Plastock, Schaum's outlines / Tata Mc-Grawhill edition.
3. Procedural elements for Computer Graphics - David F Rogers / Tata Mc Graw hill. 2nd edition.

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NANO TECHNOLOGY				

UNIT-I

Introduction Size and shape dependence of material properties at the Nanoscale, why is small good?, limits to smallness, scaling relations, can Nano Robots walk and Nanoplanes fly? Nanoscale elements in conventional technologies.

UNIT-II

Mechanics at Nanoscale: Enhancement of mechanical properties with decreasing size, Nano Electro Mechanical Systems, Nano Machines, Nano Fluidics, filtration, sorting, Molecular motors.

Top-down and bottom-up Nano Fabrication, The Intel-IBM approach to nanotechnology: lithography, etching, ion implantation, thin film deposition, Electron beam lithography

UNIT-III

Soft lithography: Nano Imprinting and Micro contact printing, Solution/plasma-phase nanofabrication, sol-gel methods, and template techniques. Imaging/characterization of Nano Structures: General considerations for imaging, Characterization of Nano Structures.

UNIT-IV

Scanning Probe Techniques: Scanning Electron Microscope (SEM), Scanning Tunnelling Microscope (STM), Scanned Probe Microscopes (SPM), Atomic Force Microscopy (AFM), and Near-Field Scanning Optical Microscope (NSOM).

UNIT-V

Metal and semiconductor Nano Particles: Synthesis, stability, control of size, Optical and electronic properties, Ultra-sensitive imaging and detection with nano particles, bioengineering applications, Catalysis.

Semiconductor and metal Nano wires: Vapour/liquid/solid growth and other synthesis techniques, Nanowire transistors and sensors.

UNIT-VI

CARBON NANOTUBES: Structure and synthesis, Electronic, vibrational, and mechanical properties, How can C nanotubes enable faster computers, brighter TV screens, and stronger mechanical reinforcement?

TEXT BOOKS:

1. Nanoscale Science and Technology – Robert W. Kelsall, Ian W. Hamley, and Mark Geoghegan / John Wiley & Sons Ltd.
2. Introduction to Nanoscale Science and Technology – Massimiliano Di Ventra, Stephane Evoy, James R. Heflin Academic Publishers.

REFERENCES:

1. Introduction to Nanotechnology By Charles P. Poole, Jr., Frank J. Owens/ John Wiley & Sons Ltd.
2. Nanochemistry: A Chemical Approach to Nanomaterials - Geoffrey A. Ozin, André C. Arsenault, Ludovico Cademartiri / RSC Publishing.

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PRODUCTION PLANNING AND CONTROL				

UNIT – I

INTRODUCTION : Definition – 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 department – Internal organization of department.

UNIT – II

FORECASTING: Importance of forecasting – Types of forecasting, their uses – General principles of forecasting – Forecasting techniques – qualitative methods and quantitative methods.

UNIT – III

INVENTORY MANAGEMENT: Functions of inventories – relevant inventory costs – ABC analysis –VED analysis – EOQ model – Inventory control systems – P-Systems and Q-Systems

UNIT – IV

Introduction to MRP & ERP, LOB (Line of Balance), JIT inventory, and Japanese concepts.

UNIT – V

ROUTING–SCHEDULING--DISPATCHING: Definition – Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. Schedule –definition – Difference with loading Scheduling Policies – Techniques, Standard scheduling methods, Dispatching – Activities of dispatcher – Dispatching procedure – follow-up –definition – Reason for existence of functions

UNIT – VI

Line Balancing, Aggregate planning, Chase planning, Expediting, controlling aspects.

TEXT BOOKS:

1. Industrial Management and Production Management/Martand T Telsung/S Chand Publishers.
2. Production and Operation Management - R.Panneerselvam/ PHI Learning Pvt. Ltd.

REFERENCES:

1. Production Planning and Control - S.K.Mukhopadhyay/ PHI Learning Pvt. Ltd.
2. Operations Management – S.N. Chary / McGraw Hill Education (India) Private Limited.
3. Inventory Control Theory and Practice - Martin K. Starr and David W. Miller/ Prentice-Hall.

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RAPID PROTOTYPING				

UNIT - I

INTRODUCTION: Definition of Prototype, Types of prototypes, Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry, and classification of RP Systems.

UNIT - II

STEREO LITHOGRAPHY SYSTEMS: Principle, Process parameters, process details, Data preparation, data files and machine details, Application.

SELECTIVE LASER SINTERING: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications, Fusion Deposition Modeling: Principle, Process parameters, Path generation, Applications.

UNIT - III

SOLID GROUND CURING: Principle of operation, Machine details, Applications, Laminated Object Manufacturing Principle of operation, LOW materials, process details, application.

CONCEPTS MODELERS: Principle, Thermal jet printer, Sander's model market, 3-D printer, Genisys Xs printer HP system – 5, object Quadra systems, Laser Engineering Net Shaping (LENS).

UNIT - IV

RAPID TOOLING: Indirect Rapid tooling, Silicon rubber tolling, Aluminium filled epoxy tooling, Spray metal tooling, cast kirksite, 3D Keltool, Direct Rapid Tooling - Direct, AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling Vs Hard tooling.

UNIT - V

SOFTWARE FOR RP: STL files, Overview of Solid view, magics, magic communicator, Internet based software, Collaboration tools, Rapid Manufacturing Process Optimization: factors influencing accuracy, data preparation errors, Part building errors, Error in finishing, influence of build orientation.

UNIT-VI

ALLIED PROCESSES: Vacuum, casting, surface digitizing, surface generation from point cloud, surface modification, data transfer to solid models.

TEXT BOOKS:

1. Rapid manufacturing - Fiham D.T, Dinjoy S. S (2002), 4th edition, Verlog, London.
2. Stereo lithography and other RP and M Technologies- Paul F. Jacobs (1996), 3rd edition, SME, New York.

REFERENCE BOOKS:

1. Rapid Prototyping - Principles and Applications- C. K. Chua, K. F. Leong, C. S. Lim (2010), 2nd edition, Yesdee publications Pvt. Ltd., Mumbai, India.

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NON DESTRUCTIVE MATERIAL EVALUATION				

UNIT - I

INTRODUCTION: Visual Methods: Optical aids, In-situ metallographic, Optical holographic methods, Dynamic inspection.

UNIT - II

PENETRANT FLAW DETECTION: Principles, Process, Penetrant systems, Liquid penetrant materials, Emulsifiers, cleaners developers, sensitivity, Advantages, Limitations, Applications.

UNIT - III

RADIOGRAPHIC METHODS: Limitations, Principles of radiography, sources of radiation, Ionizing radiation, X-rays sources, Gama-rays sources recording of radiation, Radiographic sensitivity, and Fluoroscopic methods.

UNIT - IV

ULTRASONIC TESTING OF MATERIALS: Advantages, disadvantages, Applications, Generation of Ultrasonic waves, general characteristics of ultrasonic waves - methods and instruments for ultrasonic materials testing.

UNIT - V

MAGNETIC METHODS: Advantages, Limitations, Methods of generating fields, magnetic particles and suspending liquids Magnetography, field sensitive probes, applications.

ELECTRICAL METHODS: Eddy current methods: potential-drop methods, applications.

UNIT - VI

ELECTROMAGNETIC TESTING: Magnetism, Magnetic domains, Magnetization curves, Magnetic Hysteresis, Hysteresis loop tests, comparator - bridge tests, Absolute single-coil system, applications.

OTHER METHODS: Acoustic Emission methods, Acoustic methods, Leak detection, Thermal inspection.

TEXT BOOKS:

1. Non- Destructive Test and Evaluation of Materials - Prasad (2011), 1st edition, Tata McGraw-Hill, New Delhi.
2. Non-Destructive Testing - R. Halmshaw (1991), 2nd edition, Edward Arnold, America.

REFERENCE BOOKS:

1. Electrical and Magnetic Methods of Non-Destructive Testing - Jack Blitz (1997) Springer, Germany.
2. Ultrasonic Methods of Non-Destructive Testing - Jack Blitz (1997) Springer, Germany.
3. Non-destructive Testing Techniques Ravi Prakash (2009) 2nd Edition, New Academic Science Ltd., UK.

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MICRO ELECTRO MECHANICAL SYSTEMS				

UNIT – I

INTRODUCTION: Definition of MEMS, MEMS history and development, micro machining, lithography principles & methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micro machining, wafer bonding, LIGA.

UNIT – II

MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitive, piezo electric, strain, pressure, flow, pressure measurement by micro phone, MEMS gyroscopes, shear mode piezo actuator, gripping piezo actuator, Inchworm technology.

MICRO FLUIDIC SYSTEMS: Applications, considerations on micro scale fluid, fluid actuation methods, dielectro phoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, opto electro wetting (OEW), tuning using micro fluidics, typical micro fluidic channel, microfluid dispenser, micro needle, molecular gate, micro pumps.

UNIT – III

THERMAL SENSORS AND ACTUATORS: Thermal energy basics and heat transfer processes, Thermistors, thermo devices, thermo couple, micro machined thermo couple probe, peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors, MEMS thermo vessels, pyroelectricity, shape memory alloys (SMA), U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever.

UNIT – IV

MICRO-OPTO-ELECTRO MECHANICAL SYSTEMS: Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch, wave guide and tuning, shear stress measurement.

UNIT – V

MAGNETIC SENSORS AND ACTUATORS: Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, mag MEMS actuators, by directional micro actuator, feedback circuit integrated magnetic actuator, large force reluctance actuator, magnetic probe based storage device.

Unit – VI

MICRO FLUIDIC SYSTEMS: Applications, considerations on micro scale fluid, fluid actuation methods, dielectro phoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, opto electro wetting (OEW), tuning using micro fluidics, typical micro fluidic channel, micro fluid dispenser, micro needle, molecular gate, micro pumps.

TEXT BOOK:

1. MEMS - Nitaigour Premchand Mahalik / TMH Publishing co.

REFERENCE BOOKS:

1. Foundation of MEMS - Chang Liu / Prentice Hall Ltd.
2. Bio-MEMS (Micro systems) - Gerald Urban / Springer.
3. MEMS and Micro Systems: Design and Manufacture - Tai-Ran Hsu / TMH Publishers

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GREEN ENGINEERING SYSTEMS				

UNIT-I

Biomass Energy, basic concepts, sources of biomass energy, uses of biomass energy, science and engineering aspects of biomass energy, production of biomass electricity, transmission of biomass electricity, storage of biomass electricity.

UNIT-II

ENERGY TRANSFORMATION FROM SOURCE TO SERVICES: Energy sources, sun as the source of energy; biological processes; photosynthesis; food chains, classification of energy sources, quality and concentration of energy sources; fossil fuel reserves - estimates, duration; theory of renewability, renewable resources; overview of global/ India's energy scenario.

UNIT-III

Environmental effects of energy extraction, conversion and use; sources of pollution from energy technologies, Criteria for choosing appropriate green energy technologies, life cycle cost; the emerging trends – process/product innovation-, technological/ environmental leap-frogging; Eco/green technologies for addressing the problems of Water, Energy, Health, Agriculture and Biodiversity.

UNIT-IV

THERMODYNAMIC PROCESSES - Irreversibility of energy – Entropy. Properties of steam and classification of steam engines. Carnot cycle - Rankine cycle, Current energy requirements, growth in future energy requirements, Review of conventional energy resources- Coal, gas and oil reserves and resources, Tar sands and Oil, Shale, Nuclear energy Option.

UNIT-V

Biomass fuels, market barriers of biomass fuels, biomass fuel standardization, biomass fuel life cycle, Sustainability of biomass fuels, economics of biomass fuels, Fuel stoichiometry and analysis: Fuel stoichiometry relations; Estimation of air required for complete combustion; Estimation of minimum amount of air required for a fuel of known composition; Estimation of dry flue gases for known fuel composition; Calculation of the composition of fuel & excess air supplied, from exhaust gas analysis; Dew point of products; Flue gas analysis (O₂, CO₂, CO, NO_x, SO_x).

UNIT-VI

Biomass as a major source of energy in India: Fuel-wood use in rural households. Consequences for ecosystems. Future energy scenario in rural areas. Utilization of biomass in industrial and semi industrial settings. Future utilization of biomass in India. Future of landscape management: optimal management.

TEXT BOOKS :

1. Green Energy and Technology, Biofuels, Securing the Planet's Future Energy Needs - Ayhan Demirbas 1st Edition / Springer.
2. Biomass to Renewable Energy Processes - Jay Cheng, 1st Edition / CRC press.

REFERENCE BOOKS:

1. Bioenergy and Biofuel from Biowastes and Biomass - Samir K.Khanal, Rao Y.Surampally, 1st edition / American Society of Civil Engineers,2010.
2. Alternate Source of energy - G.D.Rey / Khanna Publications.
3. Thermal Engineering-R.K.Rajput / Lakshmi Publications

SEMESTER-VIII	L	T	P	C
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AUTOMATION IN MANUFACTURING				

UNIT – I**INTRODUCTION TO AUTOMATION:**

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.

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.

UNIT -V

AUTOMATED STORAGE AND RETRIEVAL SYSTEMS: Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT – VI

ADAPTIVE CONTROL SYSTEMS: Introduction, adaptive control with optimization, Adaptive control with constraints, Application of A.C. in Machining operations. Use of various parameters such as cutting force, Temperatures, vibration and acoustic emission.

TEXT BOOK:

1. Automation, Production Systems and Computer Integrated Manufacturing : M.P. Grover./ PE/PHI

REFERENCES:

1. Computer control of Manufacturing Systems - Yoram Koren / Tata McGraw-Hill
2. CAD / CAM/ CIM - Radhakrishnan / New age publications
3. Automation by W. Buekinsham / PHI publications.

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QUAITY CONTROL AND RELIABILITY ENGINEERING				

UNIT-I

Definition of Quality- Method of control, chance, causes, assignable causes, SQC benefits and limitations. Quality assurance, Quality management, quality control, quality circles, fundamental concepts, normal curve, measure of dispersion.

UNIT-II

Distributions: Binomial, Poisson, Geometric, Hyper geometric, Gamma distribution. Poisson as an approximation to the binomial, normal, approximation to the Binomial. Review of Probability theorems.

UNIT-III

Sample as an estimate of universal process control, control charts for variables – X bar and R charts, standard deviation charts, run up and run down ,process capability studies ,control charts for attributes, fraction defective and number of defective charts, chart sensitivity, control charts for non conformities- C and U charts.

UNIT-IV

Fundamental concepts and terms, OC curves, AQL, LTPD, AOQL sampling plans, Simple, double, multiple and sequential sampling plans, stratified sampling for variables, Dodge – Romig sampling plans, bulk sampling-problem using Dodge – Romig and BIS code books – A case study in an industry.

UNIT-V

Definition, mean fracture rate, mean time to failure, mean time between failure, hard rate, hazard models. Constant hazard, linearly increasing hazard, weibull model, system reliability, series, parallel, and mixed configuration, simple problems.

UNIT-VI

Reliability improvement, redundancy, element, unit and stand by redundancy, reliability allocation for a series system, maintainability and availability, system down time, reliability and maintainability trade - off, simple problems.

TEXT BOOK (S) :

1. Statistical Quality Control – Grantt / Mc Graw Hill, ISE.,1998.
2. Concepts in Reliability Engineering - Srinath L.S / Eastwest Press Ltd., New Delhi, 1991.

REFERENCE(S) :

1. Principles of Quality Control - Jerry Banks / John Wiley, 1990.
2. Introduction to Statistical Quality Control - Montgomery D.C / John Wiley, 2008.
3. Statistical Quality Control - Gupta R.C / Khanna Publishers, 8thEdition,2008

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COMPUTATIONAL FLUID DYNAMICS (CFD)				

UNIT –I**REVIEW OF EQUATIONS GOVERNING FLUID FLOW AND HEAT TRANSFER:**

Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navierstokes equations, conservation of energy principle, and special forms of the Navier-stokes equations.

UNIT - II

Steady flow, dimensionless form of Momentum and Energy equations, Stokes equation, conservative body force fields, stream function - Vorticity formulation.

UNIT - III

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.

UNIT - IV

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 - V

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

UNIT –VI

FINITE VOLUME METHOD: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, Linear interpolation and Quadratic interpolation.

TEXT BOOK:

1. Numerical heat transfer and fluid flow - Suhas V. Patankar / Butter-worth Publishers.
2. Computational fluid dynamics - Basics with applications - John. D. Anderson / Mc Graw Hill.

REFERENCES:

1. Computational Fluid Flow and Heat Transfer-Pradip Niyogi / Pearson Publications.
2. Fundamentals of Computational Fluid Dynamics – Tapan K. Sengupta / Universities Press.

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PIPE LINE DESIGN				

UNIT I

FUNDAMENTALS OF PIPING: Definition and Application of Piping? Pipe Manufacturing? Pipe Fabrication Pipe Designations ASME Pressure Piping Design Codes

UNIT II

CLASSIFICATION OF PIPE: Manufacturing Methods Weight and Size – Standards STD, Extra Strong XS, Double Extra Strong XXS etc. Applications or Uses Pressure Temperature Rating System

UNIT III

PIPING MATERIAL SPECIFICATIONS: Ferrous Material Specifications Non Ferrous Material Specifications, Several Examples of Calculation of Standards Properties of Commercial Piping Materials

UNIT IV

PIPE FITTINGS: Types of Fitting - Butt Weld, Threaded and Socket Weld Elbow – 90 degree (LR & SR), 45 degree, Reducing Ell. Ranch Connections – Straight & Out let Tees Reducers – Concentric & Eccentric, Reducer Offsets.

UNIT V

FLANGES: Definition of Flange. Types of Flanges based on Face and Application, Forged Steel and Cast Iron Flanges. Threaded Flanges, Slip-on Flanges, Socket Welded Flanges, Welded-Neck Flanges, Blind Flanges

UNIT VI

PIPE STRESS ANALYSIS: Objectives & Definition of Stress Analysis Critical Line List Information Required for Stress Analysis Piping Loads – Static & Dynamic.

TEXT BOOKS:

1. Pipe Drafting and Design - Roy A. Parishes, Robert A. Rhea / Gulf Professional Publishing.
2. Piping and Pipeline Engineering: Design, Construction, Maintenance By George A. Antaki / CRC Press.