SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution under UGC, New Delhi)

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

BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING

CHOICE BASED CREDIT SYSTEM (CBCS)
ACADEMIC REGULATIONS, COURSE STRUCTURE AND SYLLABI FOR I, II, III AND IV YEARS
UNDER AUTONOMOUS STATUS FOR THE BATCHES ADMITTED FROM THE ACADEMIC YEAR 2016 - 17

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

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

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution under UGC, New Delhi)

ACADEMIC REGULATIONS 2016 (R16) FOR CHOICE BASED CREDIT SYSTEM (CBCS) B.TECH. DEGREE COURSES

(Applicable for Students admitted from the academic year 2016-2017)

PRELIMINARY DEFINITIONS AND NOMENCLATURES

- "Autonomous Institute / College" means an institute / college designated as autonomous institute / college by the UGC, New Delhi and JNTUH Statutes, 2014.
- "Academic Autonomy" means freedom to a College in all aspects of conducting its academic programs granted by the University for promoting excellence.
- "Commission" means University Grants Commission (UGC), New Delhi.
- "AICTE" means All India Council for Technical Education.
- "University" means the Jawaharlal Nehru Technological University, Hyderabad.
- "College" means SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY, Hyderabad unless indicated otherwise by the context.
- "Program" means: Bachelor of Technology (B.Tech) degree program
- "Branch" means specialization in a program like B.Tech degree program in Electronics and Communication Engineering, B.Tech degree program in Computer Science and Engineering etc
- "Course" or "Subject" means a theory or practical subject, identified by its course – number and course-title, which is normally studied in a semester. For example, R14MTH1101: Mathematics - I, R14CSE1102 :Data Structures etc.
- T – Tutorial, P – Practical, D – Drawing, L - Theory, C – Credits

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

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ACADEMIC REGULATIONS 2016 (R16) FOR CHOICE BASED CREDIT SYSTEM (CBCS) B.TECH. DEGREE COURSES

(Applicable for Students admitted from the academic year 2016-2017)

1 Courses of study

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

Sl. No.	Branch Code	Branch
1	1	CIVIL ENGINEERING
2	2	ELECTRICAL & ELECTRONICS ENGINEERING
3	3	MECHANICAL ENGINEERING
4	4	ELECTRONICS & COMMUNICATION ENGINEERING
5	5	COMPUTER SCIENCE & ENGINEERING
6	12	INFORMATION TECHNOLOGY

1.1 Eligibility Criteria for Admission

The eligibility criteria for admission into First year of four year B.Tech. degree programmes shall be as mentioned below:

- The candidate shall be an Indian National.
- The candidate should have completed 16 years of age as on 31st December of the academic year for which the admissions are being conducted
- Passed either Intermediate Public Examination (I.P.E) conducted by the Board of Intermediate Education, Andhra Pradesh, with Mathematics, Physics and Chemistry as optional subjects or any equivalent examination recognized by Board of Intermediate Education, Andhra Pradesh
- Seats in each programme in the Institution are classified into **Category A** and **Category B** as per the Government Orders (G.Os.)

1.1.1 Category – A Seats:

These seats will be filled through counseling as per the rank at the Common Entrance Test (EAMCET) conducted by the State Government and State Government G.Os. as per other admission criteria laid down in the G.Os.

1.1.2 Category - B Seats

These seats will be filled by the institute as per the G.Os. Issued by State Government from time to time.

1.1.3 Category: Lateral Entry

The Candidates shall be admitted into the Third semester, based on the rank secured by the candidate at Engineering Common Entrance Test (ECET (FDH)) by the Convener, ECET

2. Credits

	Semester	
	Periods / week	**Credits**
Theory	03 / 04	03 / 04
Practical	03	02
Drawing	03 / 04	02 / 03
Mini Project	02	02
Comprehensive Viva Voce	--	02
Seminar	06	02
Main Project	15	09

Table : Compulsory subjects

Sl. No.	Subject Particulars
1	All practical subjects
2	Industry oriented mini project
3	Comprehensive Viva-Voce
4	Seminar
5	Project Work

3. Distribution and Weightage of Marks

i. The performance of a student in each semester shall be evaluated subject –wise with **a maximum of 100 marks for theory and 75 marks for practical subjects.** In addition, an Industry oriented mini- project, Technical Seminar, Comprehensive viva-voce, and Main Project Work shall be evaluated for **50, 50, 100 and 200 marks** respectively.

ii. For theory subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination, Two mid examinations will be conducted in each semester as per the academic calendar. Each mid examination is evaluated for 25 marks. First mid examination should be conducted for 1 – 2 ½ Units of syllabus and the second mid examination shall be conducted for 2 ½ - 5 Units of syllabus. The mid descriptive type

exam paper consists of Section-A and Section-B.

Section-A [compulsory] consists of 5 short answer questions and each carries one mark.

Section-B consists of 6 questions out of which 4 are to be answered and each question carries 5 marks. The time duration of each mid examination is 90 minutes.

Two assignments are to be given to students covering the syllabus of first mid and second Mid examinations and these assignments and Attendance are evaluated for 5 marks each. The first assignment shall be submitted before first mid examinations and second Assignment should be submitted before second mid examination.

At the end of the semester Internal Marks Maximum of 30 for the respective subjects are allotted as follows:

a) 25 marks for the average of the two mid term examinations

b) 5 marks of the average of the two assignment marks & Attendance

- **Award of final sessional marks :** Subject-wise attendance, average marks of two assignments and mid-examination marks will be added and rounded of to the next Integer.

iii. For practical subjects there shall be a continuous evaluation during the semester for **25 sectional marks and 50 marks for end examination**. Out of the 25 marks for internal, **day-to-day work in the laboratory shall be evaluated for 10 marks**, and 10 marks for internal examination (two internal practical examinations will be conducted and the average of the two examinations will be taken into account) and 5 marks for laboratory record.

NOTE: A student who is absent for any assignment/Mid term examination for any reason what so ever shall be deemed to have secured 'zero' marks in the test/examination and no makeup test/examination shall be conducted.

iv. For the subjects having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing, Production Drawing Practice, and Estimation etc., the distribution shall be **30 marks for internal evaluation (15 marks for day-to-day work and 15 marks for internal tests (**the average of the two examinations will be taken into account**) and 70 marks for end examination.** There shall be **two internal tests** in a semester. The Internal and End Examination pattern for the above subjects may be different from the other theory subjects.

v. There shall be an **industry-oriented mini-Project**, in collaboration with an industry of their specialization, to be taken up during the vacation after III year II Semester examination. The **mini project shall be evaluated during the IV year II Semester.** The industry oriented mini project shall be submitted in report form and should be presented before a

committee, which shall be evaluated for **50 marks.** The committee consists of Head of the Department, the supervisor of mini project and a senior faculty member of the department and External Examiner.

vi. There shall be a **seminar presentation in IV year II Semester**. For the seminar, the student shall collect the information on a specialized topic other than the project topic and prepare a technical report, showing his understanding of the topic, and submit to the department, which shall be evaluated by a Departmental committee consists of the Head of the department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for **50 marks**. There shall be **no external examination for seminar.**

vii. There shall be a **Comprehensive Viva-Voce in IV year II semester**. The Comprehensive Viva-Voce will be conducted by a Committee consisting of the Head of the Department and three Senior Faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the student's understanding in various subjects studied during the B.Tech. course of study. The Comprehensive Viva-Voce is evaluated **for 100 marks** by the Committee. There will be **no internal assessment for the Comprehensive viva-voce.**

viii. The Project work shall be started by the student in the beginning of the IV year II Semester. Out of a total of **200 marks** for the project work, **50 marks shall be for Internal Evaluation** and **150 marks for the Semester end Examination**. The Semester end Examination (viva-voce) shall be conducted by a committee comprising of an external examiner, Head of the Department and the project supervisor. The evaluation of project work shall be conducted at the end of the IV year II Semester. **The Internal Evaluation shall be on the basis of three seminars conducted during the IV year II semester for 20 marks by the committee consisting of Head of the Department, project supervisor and senior faculty member of the Department and for 30 marks by the supervisor of the project.**

4. Semester End Examination

(a) **Theory Courses**

Each course is evaluated for 70 marks. Examination is of 3 hours duration.

Question paper contains two sections [Section-A and Section-B]

Section-A : This Section Carries **20 marks** [Five short answer questions of four marks each and only one question to be set from any five units] **which is compulsory.**

Section-B: This Section carries 50 marks with 5 questions consisting of two parts each (a) and (b), out of which the student has to answer either (a) or (b), not both. Each question in Part B carries 10 marks.

(b) **Practical Courses**

Each lab course is evaluated for 50 marks. The examination shall be conducted by the laboratory teacher and another senior teacher

concerned with the subject of the same/other department/Industry. The external examiner may be appointed by the Chief Superintendent in consultation with HOD as and when required.

(c) **Supplementary Examinations**

Supplementary examinations will be conducted along with regular semester end examinations. (during even semester regular examinations, supplementary examinations of odd semester and during odd semester regular examinations, supplementary examinations of even semester will be conducted).

5. Attendance Requirements

i. A student shall be eligible to appear for the Semester end examinations if he / she acquires a **minimum of 75% of attendance in aggregate of all the subjects** for that semester.

ii. Condonation of shortage of attendance in aggregate **up to 10% (65% and above and below 75%)** in a semester may be granted by **Institute Academic Committee,**

iii. A student will not be permitted to write the end examination and hence not promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek re- admission for that semester when offered next. The student seeking re-admission for a semester will automatically forfeit all/any internal marks that he obtained in all the subjects of the present semester, as applicable.

iv Shortage of Attendance **below 65% in aggregate** shall in **NO case be condoned.**

v. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that semester.

vi. A stipulated fee shall be payable towards condonation of shortage of attendance.

6. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item No.**5.**

i.. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or practical design or drawing subject or project, if he secures **not less than 35% (25 out of 70 marks)** of **marks in the end examination and a minimum of 40% of marks in the sum total of the internal evaluation and end examination taken together.**

ii. **Promotion Rules:**

Credits required for B.Tech. students to get Promotion from I to II year:

- A student will not be promoted from I year to II year unless he fulfills the academic requirement of 24 credits out of 48 credits of I year from all the examinations and secures prescribed minimum attendance.

Credits required for B.Tech. students to get Promotion from II to III year:

- A student will not be promoted from II year to III year unless he fulfills the academic requirement of 43 credits out of 72 credits up to II year I semester from all the relevant regular and supplementary examinations, whether he takes those examinations or not, and secures prescribed minimum attendance.

Credits required for B.Tech. students to get Promotion from III to IV year:

- A student will not be promoted from III year to IV year unless he fulfills the academic requirement of 72 credits out of 120 credits up to III year I semester from all the relevant regular and supplementary examinations, whether he takes those examinations or not, and secures prescribed minimum attendance.
- A student shall register and put up minimum attendance in all 192 credits and earn 192 credits. Grades obtained in the best 184 credits shall be considered for the calculation of CGPA.

7 Detained / Re-admitted Candidate

i. A detained student can seek re-admission into a semester by giving a written application and enclosing the memorandum of marks of all exams he/she has appeared till that date.
ii. Re-admission has to be effected within four weeks of the commencement of the semester. No application for re-admission will be accepted thereafter.
iii. A comprehensive list of all detained candidates is to be maintained in the Examination Branch of the College. The cases of detained candidates have to be examined by a committee of all Heads of Departments to ascertain whether a candidate when readmitted has to undergo any new subject (Substitute Subject) in view of change of course structure. The necessary decisions have to be maintained in the Examination Branch well in advance of the commencement of classes so that the candidate can be informed as and when he or she seeks re-admission.

8. Course pattern

i. The entire course of study is of four academic years. **All the I, II, III & IV years are of semester pattern .**
ii. A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may reappear for that subject at the supplementary examination whenever conducted.
iii. When a student is detained due to shortage of attendance in any semester, he/she may be re-admitted into that semester when it is offered next, **with the academic regulations of the batch into which he gets readmitted.**
iv. When a student is detained due to lack of credits in any year, he/she may be eligible to be promoted or for promotion into the next year after fulfillment of the academic requirements, **with the academic regulations of the batch into which he gets admitted**

9. Examinations and Assessment - The Grading System

For the award of grades in a course, all evaluation is done in marks as per the scheme of examination. **Marks so obtained are converted to grades at the end of semester as per the guidelines given below using Absolute Grading System.**

Award of Grade Using Absolute GRADING SYSTEM

Grade	GP	Marks
O (Out Standing)	10	≥ 90 - ≤ 100
A+	9	≥ 80 - < 90
A	8	≥ 70 - < 80
B+	7	≥ 60 - < 70
B	6	≥ 50 - < 60
C	5	≥ 45 - < 50
P	4	≥ 40 - < 45
F	0	< 40 - Fail
(Ab)	0	Absent

Semester Grade Point Average (SGPA)

The performance of a student in a semester is indicated by a number called **SGPA.** The **SGPA** is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \sum C_i P_i / \sum C_i$$

where,

C_i = The number of credits for the i^{th} course of a semester for which SGPA is to be calculated.

P_i = Grade points earned in the i^{th} course.

i_i = 1,2,……., n represent the number of courses in which a student has registered in the concerned semester the SGPA is calculated to two decimal places.

Cumulative Grade Point Average (CGPA)

An up to date assessment of the overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the student since he entered the institution.

$$CGPA = \sum C_j P_j / \sum C_j$$

where,

C_j = The number of credits for the j^{th} course up to the semester for which CGPA is to be calculated.

P_j = Grade points earned in the j^{th} course.

i_j = 1,2,……., n represent the number of courses in which a student has registered up to the semester for which the CGPA is to be calculated.

The CGPA is also calculated to two decimal places.

Note:

- As seen from above formula CGPA is **not average** of SGPA

10. Award of B.Tech. Degree and Class

A student will be declared eligible for the award of the B. Tech. Degree if he/she fulfills the following academic regulations:

i. Pursued **a course of study for not less than four academic years and not more than eight academic years.**
ii. Registered for **192 credits** and secured **192 credits.**

NOTE:

1. Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course.

2. After securing the necessary 192 Credits as specified for the successful completion of the entire UGP, an exemption of 8 secured Credits (in terms of two of their corresponding Subjects/Courses) may be permitted for optional drop out from these 192 Credits earned; resulting in 184 Credits for UGP performance evaluation, i.e., the performance of the Student in these 184 Credits shall alone be taken into account for the calculation of 'the final CGPA (at the end of UGP, which takes the SGPA of the IV Year II Semester into account)', and shall be indicated in the Grade Card of IV Year II Semester; however, the Student's Performances in the earlier individual Semesters, with the corresponding SGPA and CGPA for which already Grade Cards are given, will not be altered. Further, optional drop out for such 8 secured Credits shall not be allowed for Subjects/ Courses listed as … i) Laboratories/ Practicals, Industrial Training/ Mini-Project, iii) Seminar, iv) Major Project.

3. After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B.Tech degree he / she shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured
First Class with Distinction	≥ 7.75
First Class	6.75 ≤ CGPA < 7.75
Second Class	5.75 ≤ CGPA < 6.75
Pass Class	5.0 ≤ CGPA < 5.75

11. Withholding of Results

If the student has not paid dues to College, or if any case of indiscipline is pending against him, the result of the candidate may be withheld and he will not be allowed to go into the next higher Semester. The award or issue of the Degree may also be withheld in such cases.

12. Transitory Regulations

Students who have discontinued or have been detained for want of attendance or any other academic requirements, may be considered for readmission as and when they become eligible. They have to take up Equivalent subjects, as substitute subject in place of repetition of subjects as decided by the Institute Academic Committee.

13. Minimum Instruction Days

The minimum instruction days for each semester shall be **90 clear instruction days.**

14. There shall be **no branch transfers** after the completion of admission process.

15. The decision of the Institute Academic Committee will be final in respect of equivalent subjects for those students who are transferred from other colleges. The procedure for permitting students to transfer from other colleges will be decided by the principal / Institute Academic Committee keeping the Government Rules concerned in view.

16. TERMINATION FROM THE PROGRAMME

The admission of a student to the program may be terminated and the student is asked to leave the college in the following circumstances:

i. The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

ii. The student fails to satisfy the norms of discipline specified by the institute from time to time.

17. CURRICULUM

i. For each program being offered by the Institute, a Board of Studies (BOS) is constituted in accordance with AICTE / UGC / JNTUH statutes.

ii. The BOS for a program is completely responsible for designing the curriculum once in three years for that program.

18. GRIEVANCES REDRESSAL COMMITTEE

"Grievances and Redressal Committee" (General) constituted by the principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters. The composition of the complaints cum redressal committee shall be:

Headed by Senior Faculty member
Heads of all departments
A senior lady staff member from each department (if available)

The committee constituted shall submit a report to the principal of the college, the penalty to be imposed. The Principal upon receipt of the report from the committee shall, after giving an opportunity of being heard to the person complained against, submit the case with the committee's recommendation to the Governing Body of the college. The Governing Body shall confirm with or without modification the penalty recommended after duly following the prescribed procedure.

19. MALPRACTICE PREVENTION COMMITTEE

A malpractice prevention committee shall be constituted to examine and punish the students who does malpractice / behaves indiscipline in examinations. The committee shall consist of:

Principal.
Subject expert of which the subject belongs to.
Head of the department of which the student belongs to.
The invigilator concerned.
In-charge Examination branch of the college.

The committee constituted shall conduct the meeting on the same day of examination or latest by next working day to the incidence and punish the student as per the guidelines prescribed by the JNTUH/SICET from time to time.

Any action on the part of candidate at the examination like trying to get undue advantage in the performance at examinations or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff, who are in charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

20. STUDENT'S FEEDBACK

It is necessary for the Colleges to obtain feedback from students on their course work and various academic activities conducted. For this purpose, suitable feedback forms shall be devised by the College and the feedback obtained from the students regularly in confidence, by administering the feedback form in print or on-line in electronic form.

The feedback received from the students shall be discussed at various levels of decision making at the College and the changes/ improvements, if any, suggested shall be given due consideration for implementation.

21 CONDUCT AND DISCIPLINE

i. Each student shall conduct himself / herself in a manner befitting his / her association with SICET.

ii. He / she is expected not to indulge in any activity, which is likely to bring disrepute to the college.

iii. He / she should show due respect and courtesy to the teachers, administrators, officers and employees of the college and maintain cordial relationships with fellow students.

iv. Lack of courtesy and decorum unbecoming of a student (both inside and outside the college), willful damage or removal of Institute's property or belongings of fellow students, disturbing others in their studies, adoption of unfair means during examinations, breach of rules and regulations of the Institute, noisy and unruly behaviour and similar other undesirable activities shall constitute violation of code of conduct for the student.

v. **Ragging in any form is strictly prohibited and is considered a serious offence. It will lead to the expulsion of the offender from the college.**

vi. Violation of code of conduct shall invite disciplinary action which may include punishment such as reprimand, disciplinary probation, debarring from the examination, withdrawal of placement services, withholding of grades / degrees, cancellation of registration, etc., and even expulsion from the college.

vii. Principal, based on the reports of the warden of Institute hostel, can reprimand, impose fine or take any other suitable measures against an inmate who violates either the code of conduct or rules and regulations pertaining to college hostel.

viii. A student may be denied the award of degree / certificate even though he / she has satisfactorily completed all the academic requirements if the student is found guilty of offences warranting such an action.

ix. Attendance is not given to the student during the suspension period.

22. OTHER ISSUES

The quality and standard of engineering professionals are closely linked with the level of the technical education system. As it is now recognized that these features are essential to develop the intellectual skills and knowledge of these professionals for being able to contribute to the society through productive and satisfying careers as *innovators, decision makers and/or leaders* in the global economy of the 21st century, it becomes necessary that certain improvements are introduced at different stages of their education system. These include:

a) Selective admission of students to a programme, so that merit and aptitude for the chosen technical branch or specialization are given due consideration.

b) Faculty recruitment and orientation, so that qualified teachers trained in good teaching methods, technical leadership and student's motivation are available.

c) Instructional/Laboratory facilities and related physical infrastructure, so that they are adequate and are at the contemporary level.

d) Access to good library resources and Information & Communication Technology **(ICT)** facilities, to develop the student's *mind* effectively.

These requirements make it necessary for the College to introduce improvements like:

a) Teaching-learning process on modern lines, to provide *Add-On* Courses for *audit*/credit in a number of peripheral areas useful for student's self development.

b) Life-long learning opportunities for faculty, students and alumni, to facilitate their dynamic interaction with the society, industries and the world of work.

c) Generous use of ICT and other modern technologies in everyday activities.

23. General

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

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

iii. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

iv. In the case of any discrepancy/ambiguity/doubt arises in the above rules and regulations, the decision of the Principal shall be final.

v. The College may change or amend any or all of the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students concerned with effect from the dates notified by the College.

24. Academic Regulations for B.Tech. (Lateral Entry Scheme)

(Applicable for students admitted from the academic year 2017-2018)

i. A student shall register for all 144 credits and earn all the 136 credits. Marks obtained in all 136 credits shall be considered for the calculation of the class.

ii. A student who fails to earn 144 credits as indicated in the course structure within **six** academic years from the year of their admission shall forfeit their seat in B.Tech. programme and their admission stands cancelled.

iii. The same attendance regulations are adopted as that of B.Tech. Four year degree course.

iv. **Credits required for B.Tech. students to get Promotion from II to III year:**

- A student will not be promoted from II year to III year unless he fulfills the academic requirement of 24 credits out of 48 credits of II year from all the examinations and secures prescribed minimum attendance.

Credits required for B.Tech. students to get Promotion from III to IV year:

- A student will not be promoted from III year to IV year unless he fulfills the academic requirement of 43 credits out of 72 credits up to III year I semester from all the relevant regular and supplementary examinations, whether he takes those examinations or not, and secures prescribed minimum attendance.

- A student shall register and put up minimum attendance in all 144 credits and earn 144 credits. Grades obtained in the best 136 credits shall be considered for the calculation of CGPA.

v. **Award of B.Tech. Degree and Class:**

A student will be declared eligible for the award of the B. Tech. Degree if he/she fulfills the following academic regulations:

i. Pursued **a course of study for not less than four academic years and not more than six academic years.**

ii. Registered for **144 credits** and secured **144 credits.**

NOTE:

1. Students, who fail to fulfill all the academic requirements for the award of the degree within six academic years from the year of their admission, shall forfeit their seat in B.Tech. course.

2. After securing the necessary 144 Credits as specified for the successful completion of the entire UGP, an exemption of 8 secured Credits (in terms of two of their corresponding Subjects/Courses) may be permitted for optional drop out from these 144 Credits earned; resulting in 136 Credits for UGP performance evaluation, i.e., the performance of the Student in these 136 Credits shall alone be taken into account for the calculation of 'the final CGPA (at the end of UGP, which takes the SGPA of the IV Year II Semester into

account)' , and shall be indicated in the Grade Card of IV Year II Semester; however, the Student's Performances in the earlier individual Semesters, with the corresponding SGPA and CGPA for which already Grade Cards are given, will not be altered. Further, optional drop out for such 8 secured Credits shall not be allowed for Subjects/ Courses listed as … i) Laboratories/ Practicals, Industrial Training/ Mini-Project, iii) Seminar, iv) Major Project.

3. After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B.Tech degree he / she shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured
First Class with Distinction	≥ 7.75
First Class	6.75 ≤ CGPA < 7.75
Second Class	5.75 ≤ CGPA < 6.75
Pass Class	5.0 ≤ CGPA < 5.75

vi. All other regulations as applicable to B.Tech. four year degree course will hold good for B.Tech. (Lateral Entry Scheme).

MALPRACTICES RULES
DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Asst. – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.

10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Note : Students are advised to read the above regulations thoroughly. Ignorance with regards to the regulations cannot be construed as an excuse.

Frequently asked Questions and Answers about autonomy

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

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

2. **Shall SICET award its own Degrees?**

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

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

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

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

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

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

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

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

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

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

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

8. **Can SICET have its own Convocation?**

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

9. Can SICET give a provisional degree certificate?

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

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

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

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

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

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

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

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

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

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

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

15. Who takes Decisions on Academic matters?

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

16. What is the role of Examination committee?

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

17. Is there any mechanism for Grievance Redressal?

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

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

All such matters are defined in Rules & Regulations.

19. Who declares the result?

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

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

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

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

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

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

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

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

This is defined in the Rules & Regulations.

24 Is the College adapting Choice Based Credit System (CBCS) or Not ?
Yes, this College has adapted CBCS system with effect from the Academic Year 2016-17.

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

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

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SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution under JNTUH)

Choice Based Credit System (CBCS)

REGULATIONS – R16

Common to All Non-Circuit Branches of B.Tech.
(MECH., CIVIL)

I YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
R16MTH1101	Mathematics – I	4	0	4
R16EPH1101	Engineering Physics -1	3	1	3
R16CSE1101	Computer Programming	4	0	4
R16ECH1101	Engineering Chemistry	3	1	4
R16MED1102	Engineering Graphics –I	3	1	3
R16CSE1201	Computer Programming Lab	0	3	2
R16ECH1201	Engineering Chemistry Lab	0	3	2
R16EPH1201	Engineering Physics Lab	0	3	2
	TOTAL	**17**	**12**	**24**

I YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
R16EPH1102	Engineering Physics -II	3	1	3
R16MED1101	Engineering Mechanics	4	0	4
R16HAS1101	English	4	0	4
R16CSE1102	Data Structures Through ‘C’	3	1	3
R16MED1103	Engineering Graphics – II	3	1	4
R16CSE1202	Data Structures Through ‘C’ Lab	0	3	2
R16MED1201	Workshop practice	0	3	2
R16HAS1201	English Language & Communication Skills Lab	0	3	2
	TOTAL	**17**	**12**	**24**

* T/P/D: Tutorial/Practical/Drawing Practice

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution under UGC, New Delhi)

Choice Based Credit System (CBCS)

REGULATIONS – R16

B. Tech. MECHANICAL ENGINEERING

II YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
R16HAS1102	Environmental Studies	3	1	3
R16MTH1105	Probability and Statistics	3	1	3
R16EEE1131	Electrical and Electronics Engineering	3	1	3
R16MED1104	Mechanics of Solids	3	1	3
R16MED1105	Thermodynamics	4	0	4
R16MED1106	Metallurgy and Materials Science	4	0	4
R16EEE1211	Electrical and Electronics Engineering Lab	0	3	2
R16MED1202	Metallurgy & Mechanics of Solids Lab	0	3	2
Total		**20**	**10**	**24**

II YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
R16MED1107	Production Technology	3	1	3
R16MED1108	Kinematics of Machinery	3	1	3
R16MED1109	Thermal Engineering –I	3	1	3
R16MED1110	Mechanics of Fluids and Hydraulic Machines	3	1	3
R16MED1111	Machine Drawing	0	6	4
R16MTH1107	Mathematics –II	4	0	4
R16MED1203	Production Technology Lab	0	3	2
R16MED1204	Fluid Mechanics and Hydraulic Machinery Lab	0	3	2
Total		**16**	**16**	**24**

*** T/P/D: Tutorial/Practical/Drawing Practice**

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Choice Based Credit System (CBCS)

REGULATIONS – R16

B. Tech. MECHANICAL ENGINEERING

III YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
R16HAS1103	Managerial Economics and Financial Analysis	3	1	3
R16MED1112	Engineering Metrology	4	0	4
R16MED1113	Dynamics of Machinery	3	1	3
R16MED1114	Machine Tools	4	0	4
R16MED1115	Design of Machine Members – I	3	1	3
R16MED1116	Thermal Engineering -II	3	1	3
R16MED1205	Machine Tools & Metrology Lab	0	3	2
R16MED1206	Thermal Engineering Lab	0	3	2
Total		**20**	**10**	**24**

III YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
R16MED1124	Automobile Engineering	3	1	3
R16MED1118	Finite Element Methods	3	1	3
R16MED1119	Refrigeration and Air Conditioning	3	1	3
R16MED1120	Design of Machine Members – II	3	1	3
R16MED1121	Heat Transfer	4	0	4
R16MED1117 R16CIV1132 R16CIV1123 R16HAS1105	**Open Elective** Industrial Management Disaster Management Intellectual Property Rights Human Values and Professional Ethics	4	0	4
R16MED1207	Heat Transfer Lab	0	3	2
R16HAS1202	Advanced English Language Communication Skills Lab	0	3	2
Total		**20**	**10**	**24**

*** T/P/D: Tutorial/Practical/Drawing Practice**

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

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Choice Based Credit System (CBCS)

REGULATIONS – R16

B. Tech. MECHANICAL ENGINEERING

IV YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
R16MTH1106	Operations Research	3	1	3
R16MED1125	Power Plant Engineering	3	1	3
R16MED1126	CAD/CAM	3	1	3
R16MED1127	Instrumentation and Control Systems	3	1	3
	ELECTIVE – I	4	0	4
R16MED1128	Robotics			
R16MED1129	Mechanical Vibrations			
R16MED1130	Mechatronics			
R16MED1131	Mechanics of Composite Materials			
	ELECTIVE – II	4	0	4
R16MED1132	Unconventional Machining Processes			
R16MED1133	CNC Technology			
R16MED1134	Automation in Manufacturing			
R16MED1135	Design for Manufacturing and Assembly			
R16MED1123	Nanotechnology			
R16MED1208	Computer Aided Design & Manufacturing Lab	0	3	2
R16MED1209	Production Drawing Practice and Instrumentation Lab	0	3	2
Total		**20**	**10**	**24**

*** T/P/D: Tutorial/Practical/Drawing Practice**

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution under UGC, New Delhi)

Choice Based Credit System (CBCS)

REGULATIONS – R16

B. Tech. MECHANICAL ENGINEERING

IV YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
R16MED1136	Production Planning and Control	3	1	3
	ELECTIVE – III	3	1	3
R16CSE1142	Artificial Neural Networks			
R16HAS1107	Total Quality Management			
R16MED1138	Maintenance and Safety Engineering			
R16MED1139	Plant Layout & Material Handling			
	ELECTIVE – IV	3	1	3
R16MED1140	Renewable Energy Sources			
R16MED1141	Jet Propulsion & Rocket Engineering			
R16MED1142	Computational Fluid Dynamics			
R16MED1147	Gas Dynamics			
R16MED1210	Industry Oriented Mini Project	0	0	2
R16MED1211	Seminar	0	6	2
R16MED1212	Project Work	0	15	9
R16MED1213	Comprehensive Viva	0	0	2
Total		**9**	**24**	**24**

*** T/P/D: Tutorial/Practical/Drawing Practice**

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B.Tech. - I Year – I Semester

L	T/P/D	C
4	0	4

(R16MTH1101) Mathematics - I

UNIT - I **Solution for linear systems**

Matrices and Linear systems of equations: Elementary row transformations-Rank-Echelon form, Normal form – Solution of Linear Systems – Direct Methods- LU Decomposition- LU Decomposition from Gauss Elimination –Solution of Tridiagonal Systems-Solution of Linear Systems Eigen values, Eigen vectors – properties – Condition number of rank, Cayley-Hamilton Theorem (without Proof) - Inverse and powers of a matrix by Cayley-Hamilton theorem – Diagonalization of matrix. Calculation of powers of matrix – Modal and spectral matrices.

UNIT – II **Linear Transformations**

Real matrices – Symmetric, skew - symmetric, orthogonal matrices, Linear Transformation – Orthogonal Transformation. Complex matrices: Hermitian, Skew-Hermitian and Unitary Matrices – Eigen values and Eigen vectors of complex matrices and their properties. Quadratic forms- Reduction of quadratic form to canonical form – Rank - Positive, negative definite - semi definite - Index - signature - Sylvester law, Singular value decomposition.

UNIT – III Basic definitions of Sequences and series – Convergences and divergence – Ratio test – Comparison test– Integral test – Cauchy's root test – Raabe's test – Absolute and conditional convergence - Functions of Single Variable- Rolle's Theorem – Lagrange's Mean Value Theorem – Cauchy's Mean value Theorem – Generalized Mean Value theorem (all theorems without proof)

UNIT – IV **Application of Single variables:** Radius, Centre and Circle of Curvature – Evolutes and Envelopes. Tracing of curves in Cartesian and polar coordinates

Functions of several variables

Limits and continuity of functions of two variables- partial differentiation - total differential coefficient and chain rule - Jacobian- Functional dependence - Maxima and Minima of functions of two variables with constraints and without constraints-Lagrange's method of multipliers.

UNIT – V Multiple integrals - double and triple integrals-scalar and vector fields- Gradient-Divergence- Curl and their related properties, Potential function - Laplacian and second order operators. Line integral – work done – Surface integrals - Flux of a vector valued function. Vector integrals theorems: Green's -Stoke's and Gauss's Divergence Theorems (Statement & their Verification).

Text Books:

1. Engineering Mathematics – I by T.K. V. Iyengar, B. Krishna Gandhi & Others, S. Chand.
2. Mathematical Methods by T.K. V. Iyengar, B. Krishna Gandhi & Others, S. Chand.

References:

1. Engineering Mathematics-I , Shahnaz Bathul, PHI learning.
2. Mathematical Methods by Shahnaz Bathul, PHI learning.

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B.Tech. - I Year – I Semester

L	T/P/D	C
3	1	3

(R16EPH1101) Engineering Physics – I

UNIT – I

1. **Interference:** Superposition of waves, Young's double slit experiment, coherence, Newton's rings.
2. **Diffraction:** Fresnel and Fraunhofer diffractions, Fraunhofer diffraction at single slit and double slit, diffraction grating, Double refraction and Nicol prism.

UNIT - II

1. Ionic Bond, Covalent Bond, Metallic Bond, Hydrogen Bond, Vander Waals Bond, Calculation of Cohesive Energy of Diatonic Molecule

2.**Crystallography and Crystal Structures:** Space Lattice, Unit Cell, Lattice Parameters, Crystal Systems, Bravais Lattices, Miller Indices, Crystal Planes and Directions, Inter Planar Spacing of Orthogonal Crystal Systems, Atomic Radius, Co-ordination Number and Packing Factor of SC, BCC, FCC, Diamond Structures, Structures of NaCl, ZnS, CsCl.

Unit III

1.**X-ray Diffraction:** Basic Principles, Bragg s Law, Laue Method, Powder Method, Applications of X-ray Diffraction.

2.**Defects in Crystals:** Point Defects: Vacancies, Substitutional, Interstitial, Frenkel and Schottky Defects; Estimation of Vacancies in Frenkel and Schottky Defects Qualitative treatment of line (Edge and Screw Dislocations) Defects, Burger s Vector, Surface Defects and Volume Defects.

Unit IV

1. **Principles of Quantum Mechanics:** Waves and Particles, de Broglie Hypothesis , Matter Waves, Davisson and Germers Experiment, G. P. Thomson Experiment, Heisenbergs Uncertainty Principle - Physical Significance of the Wave Function - Schrodinger s Time Independent Wave Equation - -Particle in One Dimensional Potential Box extension to Three Dimensions.
2. **Elements of Statistical Mechanics:** Maxwell-Boltzman, Bose-Einstein and Fermi-Dirac Statistics (Qualitative Treatment), Photon Gas, Black Body Radiation, Plank's Law.

Unit V

1.Free Electron Theory of Metals: Classical free electron theory(Drude and Lorentz), Quantum Theory, Concept of Electron Gas, Fermi Energy, Density of Electrons state, Electrical conductivity of metals, relaxation time, collision time, mean free path

2. Band Theory of Solids: Electron in a periodic Potential, Bloch Theorem, Kronig-Penny Model (Quantitative Treatment), Origin of Energy Band Formation in Solids, Classification of Materials into Conductors, Semi Conductors & Insulators, Concept of Effective Mass of an Electron and Hole.

TEXT BOOKS

1. Applied Physics P.K.Palanisamy (SciTech Publications (India) Pvt. Ltd.
2. Applied Physics T. Bhima Shankaram & G. Prasad (B.S. Publications)
3. Engineering Physics P.K.Palanisamy (SciTech Publications (India) Pvt. Ltd.

REFERENCES

1. Applied Physics Mani Naidu Pearson Education
2. Modern Physics by K. Vijaya Kumar, S. Chandralingam: S. Chand & Co. Ltd
3. Introduction to Solid State Physics C. Kittel (Wiley Eastern).
4. Engineering Physics by T. Srikanth, K. Vijaya Kumar, S. Chandra Lingam, S. Chand & Co.Ltd.

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B.Tech. - I Year – I Semester

L	T/P/D	C
4	0	4

(R16CSE1101) Computer Programming

UNIT - I

Introduction to Computers – Computer Systems - Computing Environments - Computer Languages –DOS/Linux Commands - System Development – SDLC - Creating and Running Programs;

Problem Solving Techniques – Flow Charts – Algorithms – Pseudo Code – Simple Illustrations - Domain Problems;

UNIT – II

C Fundamentals – History of C Languages- Features of C- Structure of C- Reserved Words- Types - Identifiers – Constants - and Character set.;

Data Types – Basic Data Types- Derived Data Types- User Defined Data Types;

Basic Input Output- printf and scanf Functions- Format and Control Characters- Escape Sequences;

Expressions: Infix - Prefix – Postfix - Unary - Binary - Ternary;

Operators – Unary - Arithmetic- Relational- Logical – Bitwise - Assignment and Special Operators- Precedence and Associativity of Operators;

Statements – Syntax- Types of Statements- Evaluating Expressions- Type Conversions;

Branching – Conditional Branching - If - If-else – Nested If and Nested if else - Switch-Case - Control Structures (Loops) – While - Do-while - For - Dangling in Programming - Unconditional Branching - Break- Continue - Goto;

UNIT – III

Arrays – Using Arrays in C – Two Dimensional Arrays- Multi-dimensional Arrays;

Pointers – Pointer Variable – Declaration – Definition – Initialization - Pointer to Pointers - Memory Mapping- Pointer Arithmetic- Arrays of Pointers – Dynamic Memory Allocation;

Strings – Basic Concepts on Strings - String Input/Output - Arrays of Strings - String Manipulation Functions;

UNIT – IV

Functions – Function Definition- Function Declaration –Function Call – Parameters - Formal & Actual Parameters - Return Value - Scope of Parameters. Parameter Passing: Call by Value and Call by Reference - Passing Arrays as Function Arguments;

Recursion: Definition- Design – Limitations - Advantages and Disadvantages;

Macros – Pre-Processor Directives- Macro Creation- Conditional Compilation;

UNIT – V

Enumerated, Structure and Union Types – Declaration – Initialization – Operations – Programming Applications - Nested Structures- Self Referential Structures- Structures as Function Arguments and Return Value - Differences Between Structures and Unions;

Files-Types of Files **-** File Pointer - File Opening Modes- Creating Files - Writing- Reading- Appending- Editing- Copying & Merge – Standard Library Functions - Random Accessing - Command Line Arguments - Error Handling;

Text Books:

1. "Computer Science- A Structured Programming Approach Using C" by B.A. Forouzan and R.F.Gilberg- Third Edition- Thomson.
2. "The C programming Language" by B.W.Kernighan- Dennis M.Ritchie- PHI Pearson Education.

References:

1. "Working with C" by Yashavant. P Kanetkar
2. "C how to program" by Paul Deitel and Havey Deitel- PHI
3. "Absolute beginner's guide to C"- Greg M. Perry- Second Edition- Sams Pub

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B.Tech. - I Year – II Semester	L	T/P/D	C
	3	1	4

Common to All Branches
(ECE, EEE, CSE, IT, MECH., CIVIL)

(R16ECH1101) Engineering Chemistry

UNIT - I **Electrochemistry and Batteries :** Concept of Electro Chemistry, Conductors (electronic & electrolytic), Conductance-Specific, Equivalent and molar conductance, Ionic conductance, ionic mobilities and their interrelation, EMF: Electrode, Electrode potential, standard electrode potential, Nernst equation and its applications, types of electrodes- Reference Electrodes (SCE, Quinhydrone electrode), Ion Selective Electrode (Glass Electrode), Galvanic Cells & Concentration Cells, Numerical problems. Batteries: Primary Cells (dry cell and Lithium cells), secondary cells (lead-Acid cell, Ni-Cd cell). Applications of batteries. Fuel cells – Hydrogen – Oxygen fuel cells, methanol – oxygen fuel cell, Advantages and applications of fuel cells.

Unit II **Corrosion and its control :** Definition, causes and effects of corrosion, types of corrosion. Chemical and Electrochemical corrosion (mechanism), Factors affecting rate of corrosion - Purity of metal, position of metal in Galvanic series, nature of corrosion product, temperature, pH, and humidity. Corrosion control methods – Cathodic protection, sacrificial anode, impressed current cathode. Surface coatings – metallic coatings (anodic and cathodic), methods of application of metallic coatings- hot dipping, (galvanizing, tinning) cementation, cladding, electroplating (Copper Plating), Electroless Plating (Ni plating) - Organic surface coatings – paints its constituents and their functions.

Unit III **Polymers : Polymers** Definition, Classification, Types of Polymerization (Addition, Condensation & Coordination). Plastics: Thermoplastic resins & Thermo set resins, Compounding & fabrication of plastics (Compression and injection moulding), Preparation, properties, engineering applications of: PVC, PS, Teflon, & Bakelite, Fibres-Nylon - 6, 6 and terylene, Fiber Reinforced plastics (FRP) - Applications Rubbers – Natural rubber, vulcanization. Elastomers – Buna-S, Butyl rubber and Thiokol rubber. Conducting Polymers: Preparation, Mechanism of conduction and applications of Poly acetylene and poly aniline.

Unit IV **Water and Energy Sources :**
Water: Hardness of water, types of hardness, Causes of hardness, units. Numerical problems. Boiler feed water-internal treatment (Phosphate, Colloidal and Calgon conditioning), external treatment-Lime soda, Zeolite process & Ion exchange process and Numerical problems. Boiler troubles- scales & sludges, Priming and foaming, caustic embrittlement and boiler corrosion, Desalination of water-Reverse osmosis, potable water – treatment of water for domestic supply, disinfection by chlorination.

Energy sources: Fuels, Classification – Solid fuels – coal – analysis – proximate and ultimate analysis of coal, Liquid fuels – petroleum – refining of petroleum-cracking (thermal & catalytic), fixed bed catalytic cracking. Knocking (Octane and Cetane numbers) synthetic petrol –synthesis by Fischer Tropsech's process, Bergius Process; Gaseous fuels – Natural gas, CNG and LPG, Combustion – definition – HCV, LCV.

Unit V **Surface and Materials Chemistry**

Surface chemistry : Solid surfaces, types of adsorption, Langmuir adsorption isotherm, Calculation of surface area of solid & applications of adsorption, Colloids-classification of colloids, properties- Electrical (zeta potential) & optical (Tyndal effect) , applications of colloids.

Materials chemistry: Cement: composition of Portland cement, manufacture of port land Cement, setting & hardening of cement (reactions). Lubricants: classification, mechanism and properties of lubricant: Viscocity , Cloud point, pour point,flash & fire point,. Refractories: Classification, Characteristics of a good refractory.

TEXT BOOKS

1. Engineering Chemistry by P.C Jain & Monica Jain, Dhanpatrai Publishing Company (2008).
2. Text Book of Engineering Chemistry by Jyostna Cherukuri, Bharathi Kumari. VGS Publishers.
3. Text of Engineering Chemistry by S.S. Dara & Mukkanti S. Chand & Co,New Delhi(2006).

REFERENCES

1. Text Book of Engineering Chemistry by C.P. Murthy, C.V. Agarwal, A. Naidu B.S. Publications, Hyderabad (2006).
2. Chemistry of Engineering Materials by R.P Mani and K.N.Mishra, CENGAGE learning.
3. Applied Chemistry – A text for Engineering & Technology – Springar (2005).
4. Text Book of Engineering Chemistry – Shasi Chawla, Dhantpat Rai publishing Company, NewDelhi (2008).

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3	1	3

(R16MED1102) Engineering Graphics - I

UNIT - I **INTRODUCTION TO ENGINEERING DRAWING :** Principles of Engineering Graphics and their Significance – Drawing Instruments and their Use – Conventions in Drawing – Lettering – BIS Conventions. Curves used in Engineering Practice & their Constructions :

a) Conic Sections including the Rectangular Hyperbola – General method only.

b) Cycloid, Epicycloid and Hypocycloid

c) Involute.

d) Scales: plain scales, diagonal and vernier scales

Unit II **DRAWING OF PROJECTIONS OR VIEWS ORTHOGRAPHIC PROJECTION IN FIRST ANGLE PROJECTION ONLY :** Principles of Orthographic Projections – Conventions – First and Third Angle

Projections, Projections of Points and Lines inclined to both planes, True lengths, traces.

Unit III **PROJECTIONS OF PLANES & SOLIDS :** Projections of regular Planes inclined to one plane and both planes. Projections of Regular Solids inclined to both planes

Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone .

Unit IV **DEVELOPMENT OF SOLIDS:** Development of Surfaces of Right Regular Solids – Prisms, Cylinder, Pyramid Cone and their parts.\

Unit V **INTERPENETRATION OF SOLIDS:** Interpenetration of Right Regular Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

TEXT BOOK :

1. Engineering Drawing, N.D. Bhat / Charotar
2. Engineering graphics with Auto CAD- R.B. Choudary/Anuradha Publishes
3. Engineering Drawing, Narayana and Kannaiah / Scietech publishers.

REFERENCES :

1. Engineering Drawing and Graphics, Venugopal / New age.
2. Engineering Drawing- Johle/Tata Macgraw Hill.
3. Computer Aided Engineering Drawing- Trymbaka Murthy- I.K. International.

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0	3	2

(R16CSE1201) Computer Programming Lab

Objectives:

- To learn/strengthen a programming language like C- To learn problem solving techniques Recommended Systems/Software Requirements:
- Intel based desktop PC- ANSI C Compiler with Supporting Editors- IDE's such as Turbo C- Bloodshed C-
- Linux with gcc compiler(GNU Compiler collection)

Week – 1 (basic programming- if- if-else- switch)

a) Solving problems such as temperature conversion- student grading- income tax calculation- etc.- which expose students to use basic C operators.
b) Write a C program to find the roots of a quadratic equation.
c) Write a C program- which takes two integer operands and one operator form the user- performs the operation and then prints the result. (Consider the operators +, - ,*, /, % and use Switch Statement)

Week – 2 (while- do looping)

a) Write a C program to find the sum of individual digits of a positive integer.
b) Write a C program to generate all the prime numbers between 1 and n- where n is a value supplied by the user.
c) Write a program which checks a given integer is Fibonacci number or not.

Week – 3 (while- do looping)

a) 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary 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 function to read in two numbers- x and n- and then compute the sum of this geometric progression: $1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$
d) Write a C function to read in two numbers- x and n(no. of terms)- and then compute sin(x) and cos(x).

Week - 4 (For looping)

a) Write a C program to generate Pascal's triangle.
b) Write a C program to construct a pyramid of numbers.
c) Write a C program to calculate the following Sum:
Sum=$1-x^2/2!+x^4/4!-x^6/6!+x^8/8!-x^{10}/10!$
d) The total distance travelled by vehicle in 't' seconds is given by distance = $ut+1/2at^2$ where 'u' and 'a' are the initial velocity (m/sec.) and acceleration (m/sec^2). Write C program to find the distance travelled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.

Week – 5 (Arrays)

a) Write a C program to find both the largest and smallest number of an array of integers.
b) Write a C program to find Addition of Two Matrices
c) Write a C program for Calculating transpose of a matrix in-place manner.
d) Write a C program to find Matrix multiplication by checking compatibility

Week – 6 (Strings)

a) Simple programming examples to manipulate strings.
b) Verifying a string for its palindrome property
c) Write a C program that uses functions to perform the following operations:
i. To insert a sub-string in to given main string from a given position.
ii. To delete n Characters from a given position in a given string.
iii. To replace a character of string either from beginning or ending or at a specified location

Week – 7 (Pointers)

a. Simple program to understand pointer concept
b. Program which explains the use of dynamic arrays.
c. Program to enlighten dangling memory problem (Creating a 2-D array dynamically using pointer to pointers approach.

Week – 8 (Structures)

a) Examples which explores the use of structures- union and other user defined variables
b) Write a C program that uses functions to perform the following operations using Structure:
i) Reading a complex number ii) Writing a complex number
iii) Addition of two complex numbers iv) Multiplication of two complex numbers

Week – 9 (Functions)

a) Write a C function to generate Pascal's triangle.
b) Write a C function to construct a pyramid of numbers.
c) Write a C functions to find both the largest and smallest number of an array of integers.
d) Write a Pointer based function to exchange value of two integers using passing by address.

Week - 10 (Recursive Functions)

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

i) To find the factorial of a given integer.
ii) To find the GCD (Greatest Common Divisor) of two given integers.
iii) To solve Towers of Hanoi problem.

Week – 11 (Files)

a) Write a C program which copies one file to another.
b) Write a C program to reverse the first n characters in a file. (Note: The file name and n are specified on the command line)

Week – 12 (Command Line arguments and macros)

a) Copy source file contents into destination file by command line arguments
b) Write a program to implement conditional compilation

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0	3	2

Common to All Branches
(ECE, EEE, CSE, IT, MECH., CIVIL)

(R16ECH1201) Engineering Chemistry Lab

1 Titrimetry:

a. Estimation of hardness of water by EDTA method. (or)
b. Estimation of calcium in limestone by Permanganometry.
c. Estimation of Ferrous Ion by Permanganate
d. Estimation of Ferrous Ion by $K_2Cr_2O_7$

Instrumental methods:

2 Colorimetry:

a. Determination of ferrous iron in cement by colorimetric method. (or)
b. Estimation of Copper by Colorimetric method.

3 Conductometry:

a. Conductometric titration of strong acid Vs strong base. (or)
b. Conductometric titration of mixture of acids Vs strong base.

4. Potentiometry:

a. Titration of strong acid Vs strong base by potentiometry. (or)
b. Titration of weak acid Vs strong base by potentiometry.

5. Physical Properties:

a. Determination of viscosity of sample oil by redwood/oswald's viscometer
b. Determination Surface Tension of lubricants

6. Identification and Preparations:

a. Preparation of organic compounds Asprin
b. Benzimidazole

7. Mineral Analysis

a. Determination of percentage of copper in brass. (or)
b. Estimation of manganese dioxide in pyrolusite.

TEXT BOOKS

1. Practical Engineering Chemistry by K.Mukkanti, etal, B.S.Publishers, Hyd.

REFERENCES

1. Text Book of Engineering chemistry by R.N.Goyal and Harmendra Goel.
2. Instrumental Methods of Chemical Analysis, Chatwal Anand, Himalaya Publications.

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(R16EPH1201) Engineering Physics – 1 Lab

(Common for MECH, CIVIL)

1 Determination of wavelength of a given source of light by using diffraction grating.

2 To find the frequency of a tuning fork – Melde's Experiment.

3 To find the frequency of ac signal generator – A.C Sonometer.

4 Time constant of an RC – Circuit

5 LCR – Circuit

6 Newton Rings

7 Dispersive power of the material of a Prism – Spectrometer.

8 Stewart and Gee's Experiment

9 Torsional pendulum

10 Energy gap of a semi conductor.

11 Characteristics of a laser diode.

12 Numerical aperture of optical fiber

13 Bending loss of optical fiber

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	3	1	3

(R16EPH1102) Engineering Physics - II

UNIT I Semiconductor Physics: Fermi Level in Intrinsic and Extrinsic Semiconductors, Intrinsic Semiconductors and Carrier Concentration, Extrinsic Semiconductors and Carrier Concentration, Equation of Continuity, Direct & Indirect Band Gap Semiconductors, Hall Effect, Formation of PN Junction, PN Diode as a Rectifier (Forward and Reverse Bias).

Unit II Dielectric Properties: Electric Dipole, Dipole Moment, Dielectric Constant, Polarizability, Electric Susceptibility, Displacement Vector, Electronic, Ionic and Orientation Polarizations and Calculation of Polarizabilities -Internal Fields in Solids, Clausius -Mossotti Equation, Piezo-electricity, Pyro-electricity and Ferro- electricity.

Unit III Magnetic Properties: Permeability, Field Intensity, Magnetic Field Induction, Magnetization, Magnetic Susceptibility, Origin of Magnetic Moment, Bohr Magneton, Classification of Dia, Para and Ferro Magnetic Materials on the basis of Magnetic Moment, Domain Theory of Ferro Magnetism on the basis of Hysteresis Curve, Soft and Hard Magnetic Materials, Properties of Anti-Ferro and Ferri Magnetic Materials, Ferrites and their Applications Superconductivity, Meissner Effect, effect of Magnetic field, Type-1 and Type-II superconductors, Applications of Superconductors.

Unit IV 1. Lasers: Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta-stable State, Population Inversion, Lasing Action, Einstein s Coefficients and Relation between them, Ruby Laser, Helium-Neon Laser, Carbon Dioxide Laser, Semiconductor Diode Laser, Applications of Lasers.
2.Fiber Optics: Principle of Optical Fiber, Construction of Optical Fiber, Acceptance Angle and Acceptance Cone, Numerical Aperture, Types of Optical Fibers and Refractive Index Profiles, Attenuation in Optical Fibers, Optical Fibers in Communication System, Application of Optical Fibers.

Unit V 1.Acoustics of Buildings & Acoustic Quieting: Basic Requirement of Acoustically Good Hall, Reverberation and Time of Reverberation, Sabine s Formula for Reverberation Time(Quantitative Treatment), Measurement of Absorption Coefficient of a Material, Factors Affecting The Architectural Acoustics and their Remedies. Acoustic Quieting.
2.Nanotechnology: Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Quantum Confinement, Bottom-up Fabrication: Sol-gel, Precipitation, Combustion Methods; Top-down Fabrication: Chemical Vapour Deposition, Physical Vapour

TEXT BOOKS

1. Engineering Physics V. Rajaendra, TATA Mc. Graw Hill Publishers.
2. Applied Physics P.K.Palanisamy (SciTech Publications (India) Pvt. Ltd.
3. Applied Physics T. Bhima Shankaram & G. Prasad (B.S. Publications)
4. Engineering Physics P.K.Palanisamy (SciTech Publications (India) Pvt. Ltd.

REFERENCES

1. Applied Physics Mani Naidu Pearson Education
2. Engineering Physics by P. Appalanaidu and Chandrasekhar VGS Booklinks.
3. Nanotechnology : A Gentle Introduction to the next Big Idea by M.Ratner, D. Ratner

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4	0	4

(R16MED1101) Engineering Mechanics

UNIT - I Introduction to Engg. Mechanics – Basic Concepts.
Systems of Forces : Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

Unit II **Equilibrium of Systems of Forces :** Free Body Diagram, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. Lamis Theorm, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium.

Unit III **Centroid :** Centroid of simple figures (from basic principles) – Centroid of Composite Figures
Centre of Gravity : Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, pappus theorem.
Area moment of Inertia : Definition – Polar Moment of Inertia, Transfer Theorem, Moment of Inertia of Composite Figures, Product of Inertia, Transfer Formula for Product of Inertia.
Mass Moment of Inertia : Moment of Inertia of Masses, Transfer Formula for Mass Moment of Inertia, mass moment of inertia of composite bodies.

Unit IV Analysis of perfect frames (Analytical Method) – Types of Frames – Assumptions for forces in members of a perfect frame, Method of joints, Method of sections, Force table,.
Kinematics : Rectilinear and Curvelinear motion – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.
Kinetics : Analysis as a Particle and Analysis of a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion.

Unit V **Work – Energy Method :** Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.
Mechanical Vibrations : Definitions, Concepts – Simple Harmonic Motion – Free vibrations, simple and Compound Pendulums and its Applications –

TEXT BOOK :

1. Engg. Mechanics / Irving. H. Shames Prentice – Hall.
2. Engg. Mechanics / S.S. Bhavikati & J.G. Rajasekharappa
3. Engg. Mechanics, Nelson

REFERENCES :

1. Engineering Mechanics / Fedinand . L. Singer / Harper – Collins.
2. Engg. Mechanics / Timoshenko & Young.
3. Engg. Mechanics Umesh Regl / Tayal.
4. Engg. Mechanics / R.V. Kulkarni & R.D. Askhevkar
5. Engg. Mechanics/Khurmi/S.Chand.
6. Engg. Mechanics / KL Kumar / Tata McGraw Hill.

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(COMMON TO ALL BRANCHES)

		L	T/P/D	C
B.Tech. - I Year – I Semester	**for Circuit Branches**			
B.Tech. - I Year – II Semester	**for Non-Circuit Branches**	**4**	**0**	**4**

(R16HAS1101) - ENGLISH

INTRODUCTION

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competencies of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc.

The text for non-detailed study is for extensive reading/reading for pleasure. Hence, it is suggested that they read it on their own the topics selected for discussion in the class. The time should be utilized for working out the exercises given after each section, as also for supplementing the exercises with authentic materials of a similar kind for example, from newspaper articles, advertisements, promotional material etc. However, the stress in this syllabus is on skill development, fostering ideas and practice of language skills.

OBJECTIVES

To improve the language proficiency of the students in English with emphasis on LSRW skills.

To equip the students to study academic subjects more effectively using the theoretical and practical components of the English syllabus.

To develop the study skills and communication skills in formal and informal situations.

LEARNING OUTCOMES

1. Usage of English Language, written and spoken
2. Enrichment of comprehension and fluency
3. Gaining confidence in using language in verbal situations

SYLLABUS

I. Listening Skills

Objectives

1. To enable students to develop their listening skill so that they may appreciate its role in the skills based approach to language learning
2. To train students in listening so that they can comprehend the speech of people of different backgrounds and regions

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

- Listening for general content

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

II. Speaking Skills

Objectives

1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students to express themselves fluently and appropriately in social and professional contexts

- Oral practice
- Describing objects/situations/people
- Role play – Individual/Group activities (Using exercises from the five units of the prescribed text: ***Skills Annexe - Functional English for Success)***
- Just A Minute(JAM) Sessions

III. Reading Skills

Objectives

1. To raise awareness in the students about the significance of silent reading and comprehension
2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc

- Skimming the text
- Understanding the gist of an argument
- Identifying the topic sentence
- Inferring lexical and contextual meaning
- Understanding discourse features
- Scanning
- Recognizing coherence/sequencing of sentences

NOTE : *The students will be trained in reading skills using the prescribed text for detailed study*

They will be examined in reading and answering questions using 'unseen' passages which may be taken from authentic texts, such as magazines/newspaper articles

IV. Writing Skills

Objectives

1. To raise awareness in the students about writing as an exact and formal skill
2. To equip them with the components of different forms of writing, beginning with the lower order ones

- Writing sentences
- Use of appropriate vocabulary
- Paragraph writing
- Coherence and cohesiveness
- Narration / description
- Note Making
- Formal and informal letter writing
- Describing graphs using expressions of comparison

TEXTBOOKS PRESCRIBED

In order to improve the proficiency of the student in the acquisition of the four skills mentioned above, the following texts and course content, divided into **Five Units**, are prescribed:

For Detailed study: **First Textbook:** ***"Skills Annexe -Functional English for Success***", Published by Orient Black Swan, Hyderabad

For Non-detailed study

1. Second text book ***"Epitome of Wisdom",*** Published by Maruthi Publications, Guntur

The course content and study material is divided into **Five Units.**

Unit –I

1. Chapter entitled '***Wit and Humour***' from '**Skills Annexe' -Functional English for Success**, Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'*Mokshagundam Visvesvaraya'*** from ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad

L-Listening For Sounds, Stress and Intonation
S-Greeting and Taking Leave, Introducing Oneself and Others (Formal and Informal Situations)
R- Reading for Subject/ Theme
W- Writing Paragraphs
G-Types of Nouns and Pronouns
V- Homonyms, homophones, synonyms and antonyms

Unit –II

1. Chapter entitled "***Cyber Age"*** from "***Skills Annexe -Functional English for Success***" Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'*Three Days To See'*** from ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad

L – Listening for themes and facts
S – Apologizing, interrupting, requesting and making polite conversation
R- for theme and gist
W- Describing people, places, objects and events
G- Verb forms
V- noun, verb, adjective and adverb

Unit –III

1. Chapter entitled **'*Risk Management'*** from **"*Skills Annexe -Functional English for Success*"** Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'*Leela's Friend'*** by R.K. Narayan from ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad

L – for main points and sub-points for note taking
S – giving instructions and directions; Speaking of hypothetical situations
R – reading for details
W – note-making, information transfer, punctuation
G – present tense
V – synonyms and antonyms

Unit –IV

1. Chapter entitled '***Human Values and Professional Ethics'*** from "***Skills Annexe - Functional English for Success"*** Published by Orient Black Swan, Hyderabad
2. Chapter entitled ***'The Last Leaf'*** from ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad

L -Listening for specific details and information
S- narrating, expressing opinions and telephone interactions
R -Reading for specific details and information
W- Writing formal letters and CVs
G- Past and future tenses
V- Vocabulary - idioms and Phrasal verbs

Unit –V

1. Chapter entitled '***Sports and Health'*** from ***"Skills Annexe -Functional English for Success***" Published by Orient Black Swan, Hyderabad
2. Chapter entitled ***'The Convocation Speech'*** by N.R. Narayanmurthy' from ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad

L- Critical Listening and Listening for speaker's tone/ attitude
S- Group discussion and Making presentations
R- Critical reading, reading for reference
W-Project proposals; Technical reports, Project Reports and Research Papers
G- Adjectives, prepositions and concord
V- Collocations and Technical vocabulary Using words appropriately

* Exercises from the texts not prescribed shall also be used for classroom tasks.

REFERENCES

1. Contemporary English Grammar Structures and Composition by David Green, MacMillan Publishers, New Delhi. 2010.
2. Innovate with English: A Course in English for Engineering Students, edited by T Samson, Foundation Books.
3. English Grammar Practice, Raj N Bakshi, Orient Longman.
4. Technical Communication by Daniel Riordan. 2011. Cengage Publications. New Delhi.
5. Effective English, edited by E Suresh Kumar, A RamaKrishna Rao, P Sreehari, Published by Pearson
6. Handbook of English Grammar& Usage, Mark Lester and Larry Beason, Tata Mc Graw –Hill.
7. Spoken English, R.K. Bansal & JB Harrison, Orient Longman.
8. Technical Communication, Meenakshi Raman, Oxford University Press
9. Objective English Edgar Thorpe & Showick Thorpe, Pearson Education
10. Grammar Games, Renuvolcuri Mario, Cambridge University Press.
11. Murphy's English Grammar with CD, Murphy, Cambridge University Press.
12. Everyday Dialogues in English, Robert J. Dixson, Prentice Hall India Pvt Ltd.,
13. ABC of Common Errors Nigel D Turton, Mac Millan Publishers.
14. Basic Vocabulary Edgar Thorpe & Showick Thorpe, Pearson Education
15. Effective Technical Communication, M Ashraf Rizvi, Tata Mc Graw –Hill.
16. An Interactive Grammar of Modern English, Shivendra K. Verma and Hemlatha Nagarajan , Frank Bros & CO
17. A Communicative Grammar of English, Geoffrey Leech, Jan Svartvik, Pearson Education
18. Enrich your English, Thakur K B P Sinha, Vijay Nicole Imprints Pvt Ltd.,
19. A Grammar Book for You And I, C. Edward Good, MacMillan Publishers

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3	1	3

(R16CSE1102) Data Structures Through 'C'

UNIT - I ***Data Structures*** – Introduction to Data Structures- Classification of Data Structures - Abstract Data Types

Stacks - Operations of Stack- Push - Pop- Display - Necessary Conditions on Stack - Array Representation - Stack Implementations – Stack implementation of Recursion - Stack Applications – Stack Application of Expression Conversion and Expression Evaluation;

UNIT - II ***Queues***-Operations of Queue- Insert- Remove - Display - Necessary Conditions on Queues - Array Representation - Types of Queues: Circular Queue- D-Queues- Operations- Implementation and Applications – Queue Application of Scheduling Algorithms – First-In-First-Out Scheduling Algorithm - Round-Robin Scheduling Algorithm

UNIT – III ***Linked list*** – Disadvantages of Linear List and Advantages of Linked List- Singly Linked List -Operations of Linked List - Insertion- Deletion - Display – Searching - Types of Lists - Circular Linked List - Double Linked List – Operations- Implementation and Applications - Linked Representation of Stacks – Linked Representation of Queues;

UNIT – IV ***Trees*** – Definition- Terminology- Tree Types. Binary Tree- Definition- Representation- Binary Search Tree - Binary Tree Traversals - In Order - Pre Order – Post Order Tree Traversal Techniques;

Graphs – Definitions- Graph Representations- Graph Traversals - BFS and DFS;

UNIT - V ***Searching*** - Linear and Binary Search Methods;

Sorting - Bubble Sort - Selection Sort - Insertion Sort - Radix Sort - Quick Sort - Merge sort;

Complexity – Complexity of Searching and Sorting Techniques - Big O Notation- Comparison of Sorting Techniques;

Text Books

1. "Data Structures through C" by Yashavant. P Kanetkar, BPB
2. "Data Structures Using C" by Aaron M. Tenenbaum, Pearson Education

References :

1. "C& Data structures" by P. Padmanabham- Third Edition- B.S. Publications.
2. "Data Structures using C" by A.M.Tanenbaum- Y.Langsam- and M.J. Augenstein- Pearson-Education / PHI
3. "C Programming & Data Structures" by E. Balagurusamy, TMH.
4. "C Programming & Data Structures" by P. Dey- M Ghosh R Thereja, Oxford University Press
5. "C& Data structures"by E V Prasad and N B Venkateswarlu, S. Chand&Co.

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B.Tech. - I Year – II Semester

L	T/P/D	C
3	1	4

(R16MED1103) Engineering Graphics - II

UNIT - I ISOMETRIC PORJECTIONS :

Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric
Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts.

Unit II TRANSFORMATION OF PROJECTIONS :

Conversion of Isometric Views to Orthographic Views –Conventions.

Unit III PERSPECTIVE PROJECTIONS :

Perspective View : Points, Lines, Plane Figures and Simple Solids, Vanishing Point Methods(General Method only).

Unit IV Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs and methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.

Unit V Introduction to Computer aided Drafting:

Generation of points, lines, curves, polygons, simple solids, dimensioning.

TEXT BOOK :

4. Engineering Drawing, N.D. Bhat / Charotar
5. Engineering graphics with Auto CAD- R.B. Choudary/Anuradha Publishes
6. Engineering Drawing, Narayana and Kannaiah / Scietech publishers.

REFERENCES :

4. Engineering Drawing and Graphics, Venugopal / New age.
5. Engineering Drawing- Johle/Tata Macgraw Hill.
6. Computer Aided Engineering Drawing- Trymbaka Murthy- I.K. International.

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L	T/P/D	C
0	3	2

(R16CSE1202) Data Structures Through 'C' Lab

Objectives:

- To learn/strengthen a programming language like C- To learn problem solving techniques Recommended Systems/Software Requirements:
- Intel based desktop PC- ANSI C Compiler with Supporting Editors- IDE's such as Turbo C- Bloodshed C-
- Linux with gcc (GNU Compiler Collection) compiler

Week – 1 Write a C program to implement a list using array with insert, delete, display, sort, search operations

Week – 2 Write a C program to implement Stack operations (push, pop, display) using an array

Week – 3 Write a C program to implement Queue operations (insert, remove, display) using an array

Week – 4 & 5 Write a C program on Stack applications.

a) to convert infix expression into postfix expression
b) Evaluate postfix expression.
c) Implement recursion

Week – 6 Write a C program to implement scheduling algorithms using Queue

a) First – In – First – Out Algorithm b) Round Robin Algorithm

Week – 7 Write a C program to perform Linked List operations (create, insert, delete, display & find)

Week – 8 Write a C program on implementations on Linked List

a) Stack operations using Linked List (pointers)
b) Queue operations using Linked List (pointers)

Week – 9 Write a C program on Searching techniques.

a) Linear Search b) Binary Search

Week - 10 Write a C program on Sorting techniques

a) Bubble Sort b) Selection Sort

Week – 11 Write a C program on Sorting techniques

a) Insertion Sort b) Radix Sort

Week – 12 Write a C program on Sorting techniques

a) Quick Sort b) Merge Sort

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(R16MED1201) WORKSHOP PRACTICE

Part – A (IT Workshop)

Week - 1 ***Introduction to Computers***: Identify the Peripherals of Computer - Components in CPU Assembling and Disassembling - Hardware trouble shooting;

Week - 2 ***Software Installation***: Introduction to Operating System- Installation of DOS- Windows and Unix/Linux Installation - Configuring and Trouble Shooting;

Week - 3 ***Drivers and Utilities***: Threats- Virus- Worms - anti, Virus- Firewall and Device Driver's Configuration;
Office Automation: Introduction- Need of Automation- Windowing- Toolbars- Menu Application;

Week – 4 ***Word Processing***: Formatting Styles - Applying Text Effects - Paragraphs- Borders- Backgrounds - Header and Footer - Tables – Images - Hyper linking – Mail Merge;

Week - 5 ***Spreadsheets:*** Creating Tabulated Information - Overview of Toolbars - Formatting Cells - Creation of Graphs and Charts - Learning Functions and Formulas;

Week - 6 ***Presentations:*** Orientation and Layouts of Presentation - Types of Views - Inserting Styles - Design and Custom Animation - Setup and Slide Show;

Week - 7 ***Browsing***: Introduction to Internet- LAN- Connecting Computers through LAN- Accessing Computers through LAN - Access to Websites and Emails - Search Engines like Google and MSN.

REFERENCES:

1) "Building a Dream PC" by Will Smith- Que Publications.
2) "Upgrading and Repairing PCs" 12th Edition- Scott Mueller- Que Publications
3) "Repairing and Upgrading your PC" by Robert Bruce Thompson; Barbara Fritchman Thompson- O'Reilly.
4) "Microsoft Office for the Older and Wiser: Get Up and Running with Office 2010 and Office 2007" by Sean McManus.
5) "The Essential Guide to Computing: The Story of Information Technology (Essential Guide Series)" by E. Garrison Walters-

Part – B (Engineering Workshop)

Trades for Exercises : At least two exercises from each trade

Week - 1 Carpentry
Week - 2 Fitting
Week - 3 Tin-smithy and Black-Smithy
Week - 4 House Wiring
Week - 5 Foundry
Week - 6 Welding
Week - 7 Plumbing & Machine Shop

Text Books :

1. Work shop Manual – P. Kannaiah / K.L. Narayana, Scitech Publishers
2. Work shop Manual by Venkatreddy
3. Work shop practice by Hazra Chowdary

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(COMMON TO ALL BRANCHES)

B.Tech. - I Year – I Semester	**for Circuit Branches**	**L**	**T/P/D**	**C**
B.Tech. - I Year – II Semester	**for Non-Circuit Branches**	**0**	**3**	**2**

(R16HAS1201) ENGLISH LANGUAGE & COMMUNICATION SKILLS LAB

The **Language Lab** focuses on the production and practice of sounds of language and familiarises the students with the use of English in everyday situations and contexts.

Objectives

- To facilitate computer-aided multi-media instruction enabling individualized and independent language learning
- To sensitise the students to the nuances of English speech sounds, word accent, intonation and rhythm
- To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking
- To improve the fluency in spoken English and neutralize mother tongue influence
- To train students to use language appropriately for interviews, group discussion and public speaking

Syllabus: English Language Communication Skills Lab shall have two parts:

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

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

Exercise – I

CALL Lab: Introduction to Phonetics – Speech Sounds – Vowels and Consonants
ICS Lab: Ice-Breaking activity and JAM session
Articles, Prepositions, Word formation- Prefixes & Suffixes, Synonyms & Antonyms

Exercise – II

CALL Lab: Structure of Syllables - Past Tense Marker and Plural Marker – Weak Forms and Strong Forms - Consonant Clusters.
ICS Lab: Situational Dialogues – Role-Play- Expressions in Various Situations – Self-introduction and Introducing Others – Greetings – Apologies – Requests – Social and Professional Etiquette - Telephone Etiquette.
Concord (Subject in agreement with verb) and Words often misspelt- confused/misused

Exercise - III

CALL Lab: Minimal Pairs- Word accent and Stress Shifts- Listening Comprehension.
ICS Lab: Descriptions- Narrations- Giving Directions and guidelines.
Sequence of Tenses, Question Tags and One word substitutes.

Exercise – IV

CALL Lab: Intonation and Common errors in Pronunciation.
ICS Lab: Extempore- Public Speaking
Active and Passive Voice, –Common Errors in English, Idioms and Phrases

Exercise – V

CALL Lab: Neutralization of Mother Tongue Influence and Conversation Practice
ICS Lab: Information Transfer- Oral Presentation Skills
Reading Comprehension and Job Application with Resume preparation.

Minimum Requirement of infra structural facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**
   The Computer aided Language Lab for 40 students with 40 systems, one master console, LAN facility and English language software for self- study by learners.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor
   a) Speed – 2.8 GHZ
   b) RAM – 512 MB Minimum
   c) Hard Disk – 80 GB
ii) Headphones of High quality

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

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. Suresh Kumar, E. & Sreehari, P. 2009. *A Handbook for English Language Laboratories.* New Delhi: Foundation
2. *Speaking English Effectively* 2nd Edition by Krishna Mohan and N. P. Singh, 2011. Macmillan Publishers India Ltd. Delhi.
3. Sasi Kumar, V & Dhamija, P.V. *How to Prepare for Group Discussion and Interviews.* Tata McGraw Hill
4. Hancock, M. 2009. *English Pronunciation in Use. Intermediate.* Cambridge: CUP
5. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison. 2013. Orient Blackswan. Hyderabad.
6. Hewings, M. 2009. *English Pronunciation in Use. Advanced.* Cambridge: CUP
7. Marks, J. 2009. *English Pronunciation in Use. Elementary.* Cambridge: CUP
8. Nambiar, K.C. 2011. *Speaking Accurately. A Course in International Communication.* New Delhi : Foundation
9. Soundararaj, Francis. 2012. *Basics of Communication in English. New Delhi: Macmillan*
10. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.
11. **English Pronouncing Dictionary** Daniel Jones Current Edition with CD.
12. **A textbook of English Phonetics for Indian Students** by T. Balasubramanian (Macmillan)

DISTRIBUTION AND WEIGHTAGE OF MARKS

English Language Laboratory Practical Examination:

1. The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 year-end Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The year- end Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

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(R16HAS1102) ENVIRONMENTAL STUDIES

Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations

UNIT-I :

Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure and function of an ecosystem, Food chains, food webs and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT-II:

Natural Resources: Classification of Resources: Living and Non-Living resources, **Water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT-III:

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV:

Environmental Pollution and Control Technologies: Environmental Pollution & Control: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.
Overview of air pollution control technologies, Concepts of bioremediation. Global Environmental Problems and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol and Montréal Protocol.

UNIT-V:

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water,

biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

SUGGESTED TEXT BOOKS:

1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T.Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M.Masters and Wendell P. Ela .2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B.Botkin & Edward A.Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

Outcomes:

Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which inturn helps in sustainable development

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(R16MTH1105) PROBABILITY AND STATISTICS

Objectives: To learn

- Understand a random variable that describes randomness or an uncertainty in certain realistic situation. It can be of either discrete or continuous type.
- In the discrete case, study of the binomial and the Poisson random variables and the Normal random variable for the continuous case predominantly describe important probability distributions. Important statistical properties for these random variables provide very good insight and are essential for industrial applications.
- Most of the random situations are described as functions of many single random variables. In this unit, the objective is to learn functions of many random variables through joint distributions.
- The types of sampling, Sampling distribution of means ,Sampling distribution of variance, Estimations of statistical parameters, Testing of hypothesis of few unknown statistical parameters.
- The mechanism of queuing system ,The characteristics of queue, The mean arrival and service rates
- The expected queue length, The waiting line
- The random processes, The classification of random processes, Markov chain, Classification of states
- Stochastic matrix (transition probability matrix),Limiting probabilities, Applications of Markov chains

UNIT-I

Single Random variables and probability distributions : Random variables – Discrete and continuous. Probability distributions, mass function/ density function of a probability distribution . Mathematical Expectation, Moment about origin, Central moments Moment generating function of probability distribution.

Binomial, Poisson & normal distributions and their properties. Moment generating functions of the above three distributions, and hence finding the mean and variance.

UNIT-II

Multiple Random variables, Correlation & Regression: Joint probability distributions- Joint probability mass / density function, Marginal probability mass / density functions, Covariance of two random variables, Correlation - Coefficient of correlation, The rank correlation.

Regression- Regression Coefficient, The lines of regression and multiple correlation & regression.

UNIT-III

Sampling Distributions and Testing of Hypothesis

Sampling: Definitions of population, sampling, statistic, parameter. Types of sampling, Expected values of Sample mean and varience, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of varience.

Parameter estimations – likelihood estimate, interval estimations.

Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors – critical region, confidence interval, Level of significance. One sided test, two sided test,

Large sample tests:

(i) Test of Equality of means of two samples equality of sample mean and population mean (cases of known varience & unknown varience, equal and unequal variances)

(ii) Tests of significance of difference between sample S.D and population S.D.

(iii) Tests of significance difference between sample proportion and population proportion&difference between two sample proportions.

Small sample tests:

Student t-distribution,its properties; Test of significance difference between sample mean and population mean; difference between means of two small samples

Snedecor's F- distribution and it's properties. Test of equality of two population variences Chi-square distribution , it's properties, Chi-square test of goodness of fit

UNIT-IV

Queuing Theory: Structure of a queuing system, Operating Characteristics of queuing system, Transient and steady states, Terminology of Queuing systems, Arrival and service processes- Pure Birth-Death process Deterministic queuing models- M/M/1 Model of infinite queue, M/M/1 model of finite queue .

UNIT-V

Stochastic processes: Introduction to Stochastic Processes –Classification of Random processes, Methods of description of random processes, Stationary and non-stationary random process, Average values of single random process and two or more random processes. Markov process, Markov chain, classification of states – Examples of Markov Chains, Stochastic Matrix.

TEXT BOOKS:

1) Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers
2) Probability and Statistics for Engineers and Scientists by Sheldon M.Ross, Academic Press
3) Operations Research by S.D. Sarma,

REFERENCE BOOKS:

1. Mathematics for Engineers by K.B.Datta and M.A S.Srinivas,Cengage Publications
2. Probability and Statistics by T.K.V.Iyengar & B.Krishna Gandhi Et
3. Fundamentals of Mathematical Statistics by S C Gupta and V.K.Kapoor
4. Probability and Statistics for Engineers and Scientists by Jay l.Devore.

Outcomes:

- Students would be able to identify distribution in certain realistic situation. It is mainly useful for circuit as well as non-circuit branches of engineering. Also able to differentiate among many random variable involved in the probability models. It is quite useful for all branches of engineering.
- The student would be able to calculate mean and proportions (small and large sample) and to make important decisions from few samples which are taken out of unmanageably huge populations .It is Mainly useful for non-circuit branches of engineering.
- The students would be able to find the expected queue length, the ideal time, the traffic intensity and the waiting time. These are very useful tools in many engineering and data management problems in the industry. It is useful for all branches of engineering.
- The student would able to understand about the random process, Markov process and Markov chains which are essentially models of many time dependent processes such as signals in communications, time series analysis, queuing systems. The student would be able to find the limiting probabilities and the probabilities in n^{th} state. It is quite useful for all branches of engineering

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(R16EEE1131) ELECTRICAL AND ELECTRONICS ENGINEERING

Objective:
This course introduces the concepts of electrical DC and AC circuits, basic law's of electricity, instruments to measure the electrical quantities, different methods to solve the electrical networks, construction operational features of energy conversion devices i.e. DC and AC machines, transformers. It also emphasis on basics of electronics, semiconductor devices and their characteristics and operational features.

UNIT-I:
Electrical Circuits: Basic definitions, Types of elements, Ohm's Law, Resistive networks, Kirchhoff's Laws, Inductive networks, capacitive networks, Series, Parallel circuits and Star-delta and delta-star transformations. **Instruments:** Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments.

UNIT-II:
DC Machines: Principle of operation of DC Generator – EMF equation - types – DC motor types –torque equation – applications – three point starter.

UNIT-III:
Transformers: Principle of operation of single phase transformers –EMF equation – losses – efficiency and regulation.
AC Machines: Principle of operation of alternators – regulation by synchronous impedance method – Principle of operation of induction motor – slip – torque characteristics – applications.

UNIT–IV:
Diodes: P-n junction diode, symbol, V-I Characteristics, Diode Applications, and Rectifiers – Half wave, Full wave and Bridge rectifiers (simple Problems).
Transistors: PNP and NPN Junction transistor, Transistor as an amplifier, SCR characteristics and applications.

UNIT-V:
Cathode Ray Oscillos Scope: Principles of CRT (Cathode Ray Tube), Deflection, Sensitivity, Electrostatic and Magnetic deflection, Applications of CRO - Voltage, Current and frequency measurements.

EEE: TEXT BOOKS:

1. Basic concepts of Electrical Engineering, PS Subramanyam, BS Publications.
2. Basic Electrical Engineering, S.N. Singh, PHI.

EEE: REFERENCE BOOKS:
1. Basic Electrical Engineering, Abhijit Chakrabarthi, Sudipta nath, Chandrakumar Chanda, Tata-McGrawHill.
2. Principles of Electrical Engineering, V.K Mehta, Rohit Mehta, S.Chand Publications.
3. Basic Electrical Engineering, T.K.Nagasarkar and M.S. Sukhija, Oxford University Press.

4. Fundamentals of Electrical Engineering, RajendraPrasad, PHI.
5. Basic Electrical Engineering by D.P.Kothari , I.J. Nagrath, McGraw-Hill.

ECE: TEXT BOOKS:

1. Electronic Devices and Circuits, S.Salivahanan, N.Suresh Kumar, A.Vallavaraj,Tata McGraw-Hill companies..
2. Electronic Devices and Circuits, K. Lal Kishore,BS Publications.

ECE: REFERENCE BOOKS:

1. Millman's Electronic Devices and Circuits,J. Millman, C.C.Halkias, and Satyabrata Jit, Tata McGraw-Hill companies.
2. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky,PEI/PHI.
3. Introduction to Electronic Devices and Circuits, Rober T. Paynter,PE.
4. Integrated Electronics, J. Millman and Christos C. Halkias, Tata McGraw-Hill companies.
5. Electronic Devices and Circuits, Anil K. Maini, Varsha Agarwal,Wiley India Pvt. Ltd.

Course Outcomes:

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

After going through this course the student gets a thorough knowledge on basic electrical circuits, parameters, and operation of the transformers in the energy conversion process, electromechanical energy conversion, construction operation characteristics of DC and AC machines and the constructional features and operation of measuring instruments like voltmeter, ammeter, wattmeter etc...and different semiconductor devices, their voltage -current characteristics, operation of diodes, transistors, realization of various electronic circuits with the various semiconductor devices, and cathode ray oscilloscope, With which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.

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	3	**-/1/-**	**3**

(R16MED1104) MECHANICS OF SOLIDS

Objectives:

1. To gain a fundamental understanding of the concepts of stress and strain. Hooks law, Poissons ratio, Factor of safety
2. To study engineering properties of materials, stress-strain relationship, modulii and their relationship
3. To learn fundamental principles of equilibrium, compatibility, strain energy, resilience
4. To analyze determinate and indeterminate , shear forces, and bending moments and point of Contra flexture.
5. Theory of bending, assumptions and Bending moment equation.
6. shear stress distribution and analysis, Principal stresses and strains and types theories of failures, torsion of shops.
7. Theory of thin and thick cylinders. And flexture

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 modulii & the relationship between them – Bars of varying section – compositebars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

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

UNIT – III

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

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

UNIT-IV

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

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

UNIT – V

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

Thin Cylinders : Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in diameter, and volume of thin cylinders– Thin spherical shells. Introduction to thick cylinders and its theory.

TEXT BOOKS :

1. Strength of materials – R.S. Kurmi and Gupta.
2. Solid Mechanics, by Popov
3. Strength of Materials – Ryder. G.H.; Macmillan Long Man Pub.
4. Strength of Materials – W.A. Nash, TMH

REFERENCES :

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol –I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.
4. Strength of Materials by D.S Prakash Rao, Universities Press Pvt. Ltd.
5. Strength of Materials by S.S.Rattan, Tata McGraw Hill Education Pvt. Ltd.
6. Fundamentals of Solid Mechancis by M.L.Gambhir, PHI Learning Pvt. Ltd
7. Strength of Materials by R.K Rajput, S.Chand & Company Ltd.

Course Outcomes:

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

1) Solve the problems related to the theory of elasticity, concepts of stress and strain, strength and stiffness, deformations and displacements, strain energy, and load carrying capacity.
2) List different materials and structural elements to the analysis of simple structures;
3) Identify and formulate the structural problem and solve using a range of analytical methods.
4) Predict the behaviour of the solid and hollow shafts subjected to various torsion loading.
5) Theories of failure applied for various materials fully understood by student.
6) The theory of thin and thick cylinders is exposed.

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	4	**-/-/-**	**4**

(R16MED1105) THERMODYNAMICS

Course Objectives:

1. Be able to have the basic concepts of thermal sciences and their application to in formulating the thermal engineering problems.
2. Have a good understanding of first and second laws of thermodynamics and will be in a position to fully understand the analysis to be taught at the higher levels.
3. Be in a position to check the feasibility of proposed processes and cycles using the ideas of second law of thermodynamics and entropy.
4. Have the understanding of basic principles of heat transfer and related simple problems.

UNIT – I

Introduction: Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas ScaleJoule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation.

UNIT II

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

UNIT – III

Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non -flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes. Deviations from perfect Gas Model – Vader Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables- 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 IV

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction , Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

UNIT - V

Thermodynamic Cycles : Power cycles: Otto, Diesel, Dual Combustion cycles, Stirling 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.

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

TEXT BOOKS :

1. Engineering Thermodynamics / PK Nag /TMH, 5th Edition
2. Engineering Thermodynamics/E Rathakrishnan/PHI/Second Edition/2013

REFERENCE BOOKS:

1. Engineering Thermodynamics/DP Mishra/ Cengage Learning/Second impression 2012
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH
3. Thermodynamics – J.P.Holman / McGrawHill
4. Engineering Thermodynamics – Jones & Dugan
5. Engineering Thermodynamics/P.Chattopadhyay/Oxford Higher Education/Revised First Edition
6. Thermodynamics & Heat Engines – Yadav – Central Book Depot, Allahabad.

Course outcomes: After taking this course the students shall be able to:

1. Define the basic concepts of units and dimensions, systems(open and closed systems and control volumes) and its boundaries, properties, state, process, cycle, quasi-static process etc.- required as foundation for development of principles and laws of thermodynamics
2. Develop Intuitive problem solving technique
3. Use & Practice two property rule and hence thermodynamic tables, thermodynamic diagrams and concept of equation of state, also their simple application.
4. Explain heat, work and first law of thermodynamics. Application of energy balance
5. Discuss Second law of thermodynamics and its corollaries viz. absolute (thermodynamic) temperature scale, reversibility, entropy, feasibility of a process based on first law and second law, isentropic efficiency of adiabatic machines.
6. All power cycles such as Otto, Diesel, Dual Combustion, Sterling, Atkinson, Ericsson , Lenoir Cycle will be thoroughly known to the students by going through their P–V and T-S diagrams.
7. Review introductory concept of power and refrigeration cycles.

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(R16MED1106) METALLURGY AND MATERIAL SCIENCE

Objectives :

1. To Understand basics of structure of metals
2. To understand the phase diagrams of metals and steels
3. To understand the property of steels, cost irons, ceramics, composites, TTT diagram

UNIT – I

Structure of Metals: Crystallography, Miller's indices, Packing Efficiency, Density calculations. Grains and Grain Boundaries. Effect of grain size on the properties. Determination of grain size by different methods. All mechanical properties of metals including creep, fatigue and fracture.

Constitution of Alloys: Necessity of alloying, Types of solid solutions, Hume - Rothery rules, Intermediate alloy phases, Steel making process by Bessemer converter, LD converter and Electric Arc furnace.

UNIT –II

Phase Diagrams: Construction and interpretation of phase diagrams, Phase rule. Lever rule. Binary phase Diagrams, Isomorphous, Eutectic and Eutectoid transformations with examples.

UNIT –III

Engineering Materials –I STEELS:

Iron-Carbon Phase Diagram and Heat Treatment: Study of Fe-Fe3C phase diagram. Construction of TTT diagrams. Annealing, Normalizing, Hardening and Tempering of steels, Hardenability. Alloy steels.

UNIT –IV

Engineering Materials –II: CAST IRONS: Structure and properties of White Cast iron, Malleable Cast iron, Grey cast iron.

Engineering Materials-III: Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Al-Cu phase diagram, Titanium and its alloys.

UNIT – V

Engineering Materials –IV:

Ceramics, Polymers and Composites: Crystalline ceramics, glasses, cermets: structure, properties and applications. Classification, properties and applications of composites. Classification, Properties and applications of Polymers.

TEXT BOOKS:

1. Material Science and Metallurgy/ Kodgire
2. Essentials of Materials Science and engineering / Donald R.Askeland / Thomson.

REFERENCES:

1. Introduction to Physical Metallurgy / Sidney H. Avner.
2. Materials Science and engineering / William and callister.
3. Elements of Material science / V. Rahghavan
4. Engineering Material and Metallurgy – Er Amandeep Singh Wadhva
5. Materials Science for Engineering Students- Traugott Fischer 2009 Edition.

Course Outcomes:

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

1) Summarize significance Develop concept of crystal structure and its defects.
2) Metallurgy and material science and its role in manufacturing will be understood by student.
3) Able to know about steel making processes such as Bessemer convertor, LD Convertor and electric process.
4) Classify different engineering material (metals, alloys, Steels, cast irons, non- ferrous metals and alloys, tool materials, ceramics, polymers, Semi-conductor and Composites).
5) Describe phase diagram, iron – carbon diagram and heat treatment processes and TTT diagram.
6) Develop concept of diffusion, mechanical properties and high temperature material problems.
7) Select a material for a specific use based on consideration of cost and performance.

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	-	**-/3/-**	**2**

(R16EEE1211) ELECTRICAL AND ELECTRONICS ENGINEERING LAB

SECTION A: ELECTRICAL ENGINEERING:

1. Verification of KCL and KVL.
2. Magnetization characteristics of D.C. Shunt generator.
3. Speed control of DC motor.
4. Swinburne's Test on DC shunt machine.
5. Brake test on DC shunt motor.
6. OC and SC tests on Single-phase transformer.
7. Brake test on 3-phase Induction motor.
8. Regulation by an alternator by synchronous impedance method.

SECTION B: ELECTRONICS ENGINEERING:

1. PN Junction Diode Characteristics (Forward bias, Reverse bias)
2. Transistor CE Characteristics (Input and Output)
3. Study of CRO.
4. Class A Power Amplifier
5. Zener Diode Characteristics
6. Transistor CE Characteristics
7. Rectifier without Filters (Full wave & Half wave)
8. Rectifier with Filters (Full wave & half wave).

Note: Total 12 experiments are to be conducted.
(Six experiments from PART-A, Six experiments from PART-B)

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	-	**-/3/-**	**2**

(R16MED1202) METALLURGY & MECHANICS OF SOLIDS LAB

(A) 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.

(B) MECHANICS OF SOLIDS LAB :

1. Direct tension test
2. Torsion test
3. Hardness test

   a) Brinells hardness test b) Rockwell hardness test
4. Test on springs
5. Compression test on cube
6. Impact test
7. Punch shear test

NOTE : Any 10 experiments from the above are to be conducted taking atleast 4 from each section.

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(R16MED1107) PRODUCTION TECHNOLOGY

Course Objectives:

1) To equip with knowledge of the fundamental techniques to manufacture an engineering component.
2) To equip the graduates with the knowledge to manufacture engineering components through foundry, metal forming, welding, non-conventional machining and powder metallurgy techniques.
3) To prepare graduates with a solid foundation to investigate and develop a methodology and establish a manufacturing sequence to fabricate engineering components.
4) To prepare the graduates to find the probable routes to manufacture a particular engineering component.
5) To prepare the graduates to selected the most economical route to fabricate the required engineering component.

UNIT - I

Casting: Steps involved in making a casting – its applications – Patterns and Types of patterns – Pattern allowances and their construction. Types of casting processes – Solidification of casting, and their all types of sand tests.

UNIT – II

Welding: Welding Types – Oxy-fuel gas cutting – standard time and cost calculations. Arc welding, forge welding – Resistance welding, Thermit welding.

UNIT – III

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

UNIT – IV

Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts, Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements.

UNIT – V

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion – Forward extrusion and backward extrusion – impact extrusion – Extruding requirement – Tube extrusion and pipe making Hydrostatic extrusion. Forces in extrusion

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

TEXT BOOKS:

1. Manufacturing Technology (Vol. 1) / P.N. Rao/ TMH/ 2nd Edition
2. Workshop Technology (Vol. 1)/Hajra Chowdary/Asia Publishing House/2nd Edition

REFERENCE BOOKS:

1. Production Technology / Sarma P.C. / S. Chand
2. Production Technology / R.K. Jain / Khanna Publications
3. Metal Casting / T.V. Ramana Rao / New Age
4. Principles of Metal Castings / Rosenthal/TMH
5. A Course in Workshop Technology / B.S. Raghuwamshi / Dhanpat rai & Sons
6. Manufacturing Engineering and Technology / Kalpakjin S / Pearson Edu.

Course Outcomes : After taking this course the students should be able to:

1. List fundamental techniques to manufacture an engineering component.
2. Manufacture engineering components through foundry, cold and hot working, metal forming, All welding techniques, extrusion, forging
3. Predict and develop a methodology and establish a manufacturing sequence to fabricate engineering components.
4. Judge probable routes to manufacture a particular engineering component.
5. Propose the most economical route to fabricate the required engineering component.

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(R16MED1108) KINEMATICS OF MACHINERY

Course Objectives:

1. The study of kinematics machines is an applied field of mechanical engineering that is concerned with understanding the relationship between mechanism and structure, the parts of a machine and the forces that produce this motion.
2. The overall objective of this course is to learn how to analyze the all links, pairs motions of mechanisms, design mechanisms to have given motions, and analyze forces in machines.
3. This includes relative motion analysis and design of all types of gears, gear trains, cams, and linkages, simultaneous graphical and analytical analysis of position, velocity, and acceleration, considering static and inertial forces.

UNIT – I

Mechanisms : Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – Types of constrained motion – kinematic chain – Mechanism-machine-structure – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage – Grubler's Criterion

UNIT – II

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

Plane Motion of Body: Instantaneous center of rotation – centrodes and axodes – Three centers in line theorem – Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method.

UNIT - III

Straight-Line Motion Mechanisms : Exact and approximate copied and generated types – Peaucellier – Hart – Scott Russel – Grasshopper – Watt's – Tchebicheff's and Robert Mechanism – Pantographs

Steering Gears: Conditions for correct steering - Davis Steering gear, Ackerman's steering gear

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

UNIT – IV

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

Analysis of Motion Of followers: Tangent cam with Roller follower – Circular arc cam with straight, concave and convex flanks

UNIT – V

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

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

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

TEXT BOOKS:

1. Theory of Machines and Mechanisms / JOSEPH E. SHIGLEY/ Oxford / 3rd Edition / International Edition
2. Theory of Machines / Thomas Bevan / Pearson/ 3rd Edition

REFERENCE BOOKS:

1. Theory of Mechanism and Machines / Jagdish Lal / Metropolitan Book Company
2. Theory of Machines / S.S. Rattan / Tata McGraw Hill Publishers
3. Kinematics & Dynamics of machinery / Norton/TMH
4. Theory of machines / Sadhu Singh / Pearson
5. Mechanism and Machine Theory / JS Rao and RV Duggipati / New Age.
6. Theory of Machines by / R.K. Bansal (Lakshmi Publications).

Course Outcomes:

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

1. Understand the fundamentals of the theory of kinematics of machines.
2. Understand techniques for studying motion of machines and their components.
3. Distinguish kinematic and kinetic motion, change link machine structure and mechanism
4. Identify the basic relations between distance, time, velocity, and acceleration.
5. Apply vector mechanics as a tool for solving kinematic problems.
6. Create a velocity and acceleration drawing of cam and a real-world mechanism.
7. Use graphical and analytic methods to study the motion of a planar mechanism.
8. Design of basic gear trains.
9. Design of basic cam systems, all types straight line mechanisms, steering mechanisms.
10. Design of higher pairs and hooks joints.
11. An ability to identify, formulate, and solve mechanical engineering problems.

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(R16MED1109) THERMAL ENGINEERING –I

Course Objectives:

1. To give an overview of Internal Combustion Engines, their classification, applications, operation and processes.
2. To carry out thermodynamic analysis of various cycles of operation.
3. To give complete knowledge of type of fuels used in IC engines and the fuel supply systems
4. To describe combustion phenomena in IC engines
5. To describe rotary, axial, reciprocating compressors and types of refrigeration systems and their cop calculation

UNIT – I

I.C. Engines:

Four & Two stroke engine – SI & CI engines – Valve and Port Timing Diagrams – Fuel Injection Systems for SI engines – Fuel injection systems for CI engines – ignition – Cooling and Lubrication system – Fuel properties and Combustion Stoichiometry.

UNIT – II

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

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

UNIT – III

Testing and Performance of Engines and Compressors: Measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition Brake power – Performance test – Heat balance sheet and chart Classification of compressors – Fans, blowers and compressors – positive displacement and dynamic types – reciprocating and rotary types.

UNIT – IV

Rotary, Dynamic and Axial Flow (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations. **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 – powers, Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor – isentropic efficiency – pressure rise calculations – Polytropic efficiency.

UNIT – V

Refrigeration: Mechanical Refrigeration and types – units of refrigeration – Air Refrigeration system, details and principle of operation – applications of air refrigeration, Vapour compression refrigeration systems – calculation of COP – effect of superheating and sub cooling, desired properties of refrigerants and common refrigerants – Vapour absorption system – mechanical details – working principle, use of p-h charts for calculations.

TEXT BOOKS :

- I.C. Engines / V. Ganesan / TMH
- Thermal Engineering / R.K. Rajput / Lakshmi Publications / Reprints 2011.

REFERENCE BOOKS :

1. Thermal Engineering / P.K. Nag / 3rd Edition
2. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons
3. Engineering fundamentals of IC Engines – Pulkrabek / Pearson / PHI
4. Thermal Engineering / Rudramoorthy / TMH
5. Thermodynamics / Heat Engiens / B. Yadav / Central Book Depot., Allahabad
6. I.C. Engines / Heywood / McGrawHill.

Course Outcomes:

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

1. Classify various types of I.C. Engines and Cycles of operation.
2. Express the effect of various operating variables on engine performance
3. Discuss fuel metering and fuel supply systems for different types of engines
4. Distinguish normal and abnormal combustion phenomena in SI and CI engines
5. Justify the suitability of conventional fuels for IC engines.
6. Rotary, axial, reciprocating air compressors , their working principles, capabilities performance are known after completion of course and types of refrigeration systems and their cop calculation

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(R16MED1110) MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

Course Objectives:

1. To develop a concept of fluid and an understanding of Continuum model of fluid motion
2. Development of basic concepts of continuum mechanics like localized force distributions, Eulerian and Lagrangian frames of reference and mathematical derivatives.
3. Development of principles of fluid statics and their applications.
4. To provide knowledge of kinematic aspects of fluid motion and basic methods of flow visualization.
5. Development of tools for analysis of fluid motions using Finite Control Volume approach.
6. To provide basic knowledge of incompressible flow in circular pipes and exposure to design problems involving piping systems.
7. To develop basic concepts of compressible flow and development of Quasi-1D isentropic flow theory for variable area flow passages.
8. Analysis of Normal Shock waves.

UNIT – I

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

UNIT – II

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

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

UNIT – III

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

Closed conduit flow: Reynold's experiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line hydraulic gradient line. Measurement of flow: pitot tube, venturimeter, and orifice meter, Flow nozzle

UNIT – IV

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

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

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

UNIT – V

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

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

TEXT BOOKS:

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.

REFERENCE BOOKS:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.

Course Outcomes:

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

1. Generate mathematical models of fluid motion including steady and unsteady flow.
2. Recite fluid properties and fluid statics.
3. State and visualize fluid kinematics.
4. Predict and design a fluid dynamical system based on inviscid theory.
5. Model compressible flow systems.
6. Design of hydraulic Impulse, Francis, Kaplan turbines and design of centrifugal and reciprocating pumps and their specifications , working principles and their characteristics
7. To understand boundary layer concepts, types of losses in pipes and measurement of flow.
8. Able to understand basics of turbo machines, pelton wheel, francis turbine and Kaplan turbine.
9. Centrifugil and Reciprocating pumps.

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(R16MED1111) MACHINE DRAWING

Course Objectives:

1. To develop the technical skills necessary to generate an engineering drawing and an engineering
2. To introduce the elements of engineering communications; including graphical representation of Machines and its elements.
3. To model simple assembly drawings and prepare detailed part drawings with geometric dimensioning .

PART – A Machine Drawing Convention:

Need for drawing conventions – introduction to IS conventions – Conventional representation of materials, common machine elements such as screws, nuts, bolts, keys, gears, webs, ribs. Methods of dimensioning, general rules for sizes and placement of dimension for holes, centers, curved and tapered features. Title boxes, their size, location and details – common abbreviations & their liberal usage. Types of Drawings – working drawings for machine parts.

Drawing of Machine Element

Simple Parts **-** Selection of Views, additional views for the following machine elements and parts with every drawing proportion. Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws. Keys, cottered joints and knuckle joint. Rivetted joints for plates. Shaft coupling, spigot and socket pipe joint.
Journal, pivot and collar and foot step bearings.

PART – B ASSEMBLY DRAWINGS:

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions. Engine parts – stuffing boxes, cross heads, Eccentrics - connecting rod, piston assembly. Machine tool parts: Tail stock, Tool Post, Machine Vices – Screws Jacks – Plummer Block.

VALVES: Spring loaded safety valve, feed check valve and air cock.

Note: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

TEXT BOOK:

1. Machine Drawing – K.L. Narayana / New Age International Publishers.
2. Textbook of Machine Drawing/K.C. John / PHI/ Eastern Economy Edition

REFERENCE BOOKS:

1. Machine Drawing – P.S.Gill.
2. Machine Drawing / Junnarkar N.D. / Pearson Edu.
3. Machine Drawing / Bhattacharya/Oxford University Press.
4. Machine Drawing / N.D. Bhat / Charotar
5. A Textbook of Machine Drawing / R.K. Dhawan / S. Chand.

Course Outcomes:

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

1. Describe the theory of projections and IS Conventions of drawing
2. Apply various concepts engineering graphics like dimensioning, conventions and standards related to machine drawings in order to become professionally efficient.
3. Read and interpret assembly drawings with moderate complexity.
4. Explain the conventions and the methods of assembly drawings.
5. Develop visualization skills so that they can apply these skills in developing new products.
6. To understand the concepts of different types valves.

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(R16MTH1107) MATHEMATICS –II

Objectives:

- The objective is to find the relation between the variables x and y out of the given data (x,y).
- The unit also aims to find such relationships which exactly pass through data or approximately satisfy the data under the condition of least sum of squares of errors.
- The aim of numerical methods is to provide systematic methods for solving problems in a numerical form using the given initial data.
- This topic deals with methods to find roots of an equation and solving a differential equation.
- The numerical methods are important because finding an analytical procedure to solve an equation may not be always available.
- In the diverse fields like electrical circuits, electronic communication, mechanical vibration and structural engineering, periodic functions naturally occur and hence their properties are very much required.
- Indeed, any periodic and non-periodic function can be best analyzed in one way by Fourier series and transforms methods.
- The unit aims at forming a partial differential equation (PDE) for a function with many variables and their solution methods. Two important methods for first order PDE's are learnt. While separation of variables technique is learnt for typical second order PDE's such as Wave, Heat and Laplace equations.
- In many Engineering fields the physical quantities involved are vector-valued functions.
- Hence the unit aims at the basic properties of vector-valued functions and their applications to line integrals, surface integrals and volume integrals.

UNIT – I

Vector Calculus: Vector Calculus: Scalar point function and vector point function, Gradient-Divergence- Curl and their related properties. Solenoidal and irrotational vectors – finding the Potential function. Laplacian operator. Line integral – work done – Surface integrals -Volume integral. Green's Theorem, Stoke's theorem and Gauss's Divergence Theorems (Statement & their Verification).

UNIT – II

Fourier series and Fourier Transforms: Definition of periodic function. Fourier expansion of periodic functions in a given interval of length 2π . Determination of Fourier coefficients – Fourier series of even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

Fourier integral theorem - Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

UNIT – III

Interpolation and Curve fitting

Interpolation: Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences –Central differences – Symbolic relations of symbols. Difference expressions – Differences of a polynomial-Newton's formulae for interpolation - Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

Curve fitting: Fitting a straight line –Second degree curve-exponential curve-power curve by method of least squares.

UNIT – IV : Numerical techniques

Solution of Algebraic and Transcendental Equations and Linear system of equations: Introduction – Graphical interpretation of solution of equations .The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method .

Solving system of non-homogeneous equations by L-U Decomposition method (Crout's Method). Jacobi's and Gauss-Seidel iteration methods.

UNIT – V

Numerical Integration and Numerical solutions of differential equations:

Numerical integration - Trapezoidal rule, Simpson's 1/3rd and 3/8 Rule , Gauss-Legendre one point, two point and three point formulas.

Numerical solution of Ordinary Differential equations: Picard's Method of successive approximations. Solution by Taylor's series method – Single step methods-Euler's Method-Euler's modified method, Runge-Kutta (second and classical fourth order) Methods.

Boundary values & Eigen value problems: Shooting method, Finite difference method and solving eigen values problems, power method

TEXT BOOKS:

1. Advanced Engineering Mathematics by Kreyszig, John Wiley & Sons.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.

REFERENCES:

1. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi & Others, S. Chand.
2. Introductory Methods by Numerical Analysis by S.S. Sastry, PHI Learning Pvt. Ltd.
3. Mathematical Methods by G.Shankar Rao, I.K. International Publications, N.Delhi
4. Advanced Engineering Mathematics with MATLAB, Dean G. Duffy, 3rd Edi, 2013, CRC Press Taylor & Francis Group.
5. Mathematics for Engineers and Scientists, Alan Jeffrey, 6ht Edi, 2013, Chapman & Hall/ CRC
6. Advanced Engineering Mathematics, Michael Greenberg, Second Edition. Person Education
7. Mathematics For Engineers By K.B.Datta And M.A S.Srinivas, Cengage Publications

Outcomes:

From a given discrete data, one will be able to predict the value of the data at an intermediate point and by curve fitting, can find the most appropriate formula for a guessed relation of the data variables. This method of analysis data helps engineers to understand the system for better interpretation and decision making

- After studying this unit one will be able to find a root of a given equation and will be able to find a numerical solution for a given differential equation.
- Helps in describing the system by an ODE, if possible. Also, suggests to find the solution as a first approximation.
- One will be able to find the expansion of a given function by Fourier series and Fourier Transform of the function.
- Helps in phase transformation, Phase change and attenuation of coefficients in acoustics.
- After studying this unit, one will be able to find a corresponding Partial Differential Equation for an unknown function with many independent variables and to find their solution.
- Most of the problems in physical and engineering applications, problems are highly non-linear and hence expressing them as PDEs'. Hence understanding the nature of the equation and finding a suitable solution is very much essential.
- After studying this unit, one will be able to evaluate multiple integrals (line, surface, volume integrals) and convert line integrals to area integrals and surface integrals to volume integrals.
- It is an essential requirement for an engineer to understand the behavior of the physical system.

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	-	**-/3/-**	**2**

(R16MED1203) PRODUCTION TECHNOLOGY LAB

I. METAL CASTING LAB:

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

II. WELDING LAB:

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

III MECHANICAL PRESS WORKING

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

IV. PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

REFERENCE BOOK

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

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(R16MED1204) FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

1. Impact of jet on vanes
2. Performance test on Pelton wheel
3. Performance test on Francis turbine.
4. Performance test on Kaplan turbine.
5. Performance test on single stage centrifugal pump.
6. Performance test on multi-stage centrifugal pump.
7. Performance test on reciprocating pump.
8. Calibration of Venturimeter
9. Calibration of Orifice meter
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline
12. Verification of Bernoulli's equation.

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

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B.Tech. - III Year – I Semester	L	T/P/D	C
	3	-/1/-	3

(R16HAS1103) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Objectives:

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

Unit I

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

Unit II

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

Unit III

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

Unit IV

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

Unit V

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

TEXT BOOKS:

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

REFERENCES:

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

Outcomes:

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

- Understand the market dynamics namely, demand and supply, demand forecasting, elasticity of demand and supply, pricing methods and pricing in different market structures.
- Gain an insight into how production function is carried out to achieve least cost combination of inputs and cost analysis.
- Analyse how capital budgeting decisions are carried out.
- Understanding the framework for both manual and computerised accounting process
- Know how to analyse and interpret the financial statements through ratio analysis.

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(R16MED1112) ENGINEERING METROLOGY

Objectives:

a) Thorough evaluation of newly developed products, to ensure that components designed are within the process and measuring instrument capabilities available in the plant.
b) To determine the process capabilities and ensure that these are better than the relevant component tolerances.
c) To determine the measuring instrument capabilities and ensure that these are adequate for their respective measurements.
d) To minimise the cost of inspection by effective and efficient use of available facilities, and to reduce the cost of rejects and rework through application of Statistical Quality Control Techniques.
e) Standardisation of measuring methods. This is achieved by laying down inspection methods for any product right at the time when production technology is prepared.
f) Preparation of designs for all gauges and special inspection fixtures.

UNIT - I:

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

UNIT - II:

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

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

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

UNIT - III:

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

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

UNIT - IV:

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

UNIT - V:

Measurement Through Comparators: Comparators: Mechanical, Electrical and Electronic Comparators, pneumatic comparators and their uses in mass production.

Screw Thread Measurement: Element of measurement - errors in screw threads - measurement of effective diameter, angle of thread and thread pitch, profile thread gauges.

Machine Tool Alignment Tests: Requirement of Machine Tool Alignment Tests, Alignment tests on lathe, milling, drilling machine tools, Preparation of acceptance charts.

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 / R. K. Jain / Khanna Publishers
2. Engineering Metrology / I C Gupta / Dhanpath Rai

REFERENCE BOOKS:

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

Course Outcomes :

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

- Able to understand linear measurement and angular measurements, limit gages plug gages as well as optical measurements.
- Make accurate and precise dimensional and physical measurements.
- Calculate Test Uncertainty Ratios (TURs) – defined as the Uncertainty of the Unit Under Test to that of the Standard/Calibrator.
- Apply critical and analytical thinking skills in problem solving situations
- To understand concepts of surface roughness measurement, thread measurement, machine tool alignment tests on lathe milling and drilling machine.

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(R16MED1113) DYNAMICS OF MACHINERY

Objectives :

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

UNIT - I:

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

UNIT - II:

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

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

UNIT - III:

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

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

UNIT - IV:

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

UNIT - V:

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

TEXT BOOKS:

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

REFERENCES BOOKS:

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

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

- Be proficient in the use of mathematical methods to analyze the forces and motion of complex systems of linkages.
- Be able to design linkage, cam and gear mechanisms for a given motion or a given input/output motion or force relationship and friction circle and friction axis.
- Be able to analyze the motion and the dynamical forces acting on mechanical systems composed of linkages, gears and cams.
- Students able to analyze all types of brakes, Governors, balancing of mosses, Hammerblow, swaying couple, traction effort
- Study of transvers and forced vibrations, whirling of shafts and torsional vibrations.

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(R16MED1114) MACHINE TOOLS

Objectives :

Where students acquire the ability to (1) Formulate problems in metal cutting and evaluate the cutting parameters when vendor gives machine requirement or cutting condition requirement, (2) determine a complete solution to metal cutting problems using mathematical or graphical techniques, and (3) determine physical and design interpretations of metal cutting parameters in design and sale of machine tools.

UNIT - I:

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

UNIT - II:

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

UNIT - III:

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

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

UNIT - IV:

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

UNIT - V:

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

TEXT BOOKS:

1. Production Technology / HMT / Tata Mc Graw Hill.
2. Production Technology / R. K. Jain and S. C. Gupta / Khanna Pulishers.

REFERENCES BOOKS:

1. Principles of Machine Tools / Bhattacharya A and Sen. G. C / New Central Book Agency.
2. Workshop Technology - Vol. - II / B. S. Raghuvamsi.
3. Elements of Work Shop Technology - Vol. II / Hajra Choudary / Media Promoters.
4. Fundamentals of Metal Machining and Machine Tools / Geofrey Boothroyd / Mc Graw Hill.
5. Manufacturing Processes / JP Kaushish / Prentice Hall / 2nd Edition.
6. Machine Tools / C Elanchezhian & M. Vijayan / Anuradha Publications.

Outcomes :

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

1. Able to understand metal cutting principles by using all types of the cutting tools with without the coolants. All types of the chip formations.
2. Apply analytical tools from a variety of their technical specifications
3. Perform cutting force analysis of metal cutting machines
4. Perform chip formation analysis of metal cutting machines
5. Analysis various machining processes and calculate relevant quantities such as velocities, forces, powers etc.
6. Identify all types of lathe machines, there operations, drilling machines, milling machines, boring machines, shaper, slotter and planner and their cutting operations and kinematic schemes.
7. Have a basic knowledge of safe workshop practice and the environmental implications of machining process decisions
8. Understand the limitations of various machining processes with regard to shape formation and surface quality and the impact this has on design
9. Explain the relationship between manufacturing technology and systems, the impact of manufacturing on the economy and the relationship between materials selection, design and manufacture
10. Study of classification of grinding machine, types of abrasives and super finishing operations.

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(R16MED1115) DESIGN OF MACHINE MEMBERS – I

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

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

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

UNIT – I

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

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

UNIT – II

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

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

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

UNIT – III

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

UNIT – IV

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

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

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

UNIT – V

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Outcomes :

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

1. Students will be able to identify the elements of the design process.
2. Students will be able to define strict liability, negligence and express and implied warrantee.
3. Students will be able to list the fundamental canons of engineering ethics.
4. Students will be able to identify or define the yield stress and the ultimate stress of a material.
5. Students will be able to calculate the endurance limit of a material with appropriate corrections.
6. Students will be able to identify the stresses acting on a surface and find principal stresses.
7. Students will be able to evaluate loading and stress results using principal shear stress criterion.
8. Students will be able to evaluate loading and stress results using maximum distortion energy criterion.
9. Students will be able to create a Soderberg endurance failure line.
10. Understanding all types of welded joints, keys, cotter, knuckle joints, shafps, couplings and mechanical springs.

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(R16MED1116) THERMAL ENGINEERING -II

Course Objectives:

At the beginning of this course the student will

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

UNIT - I:

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

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

UNIT - II:

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

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

UNIT - III:

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

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

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

UNIT - IV:

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

UNIT - V:

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

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

TEXT BOOKS:

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

REFERENCES BOOKS:

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

Course outcomes:

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

- After taking this course the students shall be able to conduct experiments on the Boilers, Turbines.
- The students thoroughly understood the principles of Jet Propulsion and rockets.
- Study of the knowledge
- To study the steam turbines, Gas turbines, steam condensers
- To study the jet population and rocket working principles.

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(R16MED1205) MACHINE TOOLS & METROLOGY LAB

Section - A:

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

Section - B:

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

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(R16MED1206) THERMAL ENGINEERING LAB

PERFORM ANY 10 OUT OF THE 12 EXERCISES

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

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B.Tech. - III Year – II Semester

L	T/P/D	C
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(R16MED1124) AUTOMOBILE ENGINEERING

Course Objectives:

The purpose of this course is to impart adequate knowledge in both practically and theoretically, covering the various types of power-driven vehicles and to familiarize the students with the fundamentals of Automotive Engine System, Chassis and suspension system, braking and transmission system, and cooling system. The students are acquainted with the operation, maintenance and repairs of all components of the various transportation vehicles.

UNIT – I

Introduction : Layout of automobile – introduction chassis and body components . types of Automobile engines. – power unit – Introduction to engine lubrication – engine servicing.

Fuel System :S.I. Engine : Fuel supply systems, Mechanical and electrical fuel pump – filters – carburettor – types – air filters – petrol injection. Introduction to MPFI and GDI Systems.

C.I. Engines : Requirements of diesel injection systems, types of injection systems, DI Systems IDI systems. fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps. Introduction CRDI and TDI Systems.

UNIT – II

Cooling System : Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporative cooling – pressure sealed cooling – antifreeze solutions.

Ignition System : Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

Electrical System : Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT – III

Transmission System : Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, constant mesh, synchro mesh gear boxes, epicyclic gear box , over drive, torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

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

UNIT – IV

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

Steering System : Steering geometry – camber, caster, king pin inclination, combined angle, toe-in, toe-out, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

UNIT – V

Emissions from Automobiles – Pollution standards National and international – Pollution Control – Techniques – Multipoint fuel injection for SI Engines. Common rail diesel injection, Energy alternatives – Solar, Photo-voltaic, hydrogen, Biomass, alcohols, LPG, CNG, liquid Fuels and gaseous fuels, Hydrogen as a fuel for IC Engines. - their merits and demerits. Standard Vehicle maintenance practice.

TEXT BOOKS :

1. Automobile Engineering / William H Crouse/McGraw Hill-2012.
2. A Text Book Automobile Engineering–Manzoor, Nawazish Mehdi & Yosuf Ali, Frontline Publications.

REFERENCES :

1. A Text Book of Automobile Engineering by R K Rajput. Laxmi Publications.
2. Automotive Mechanics / Heitner.
3. Automotive Engineering / Newton Steeds & Garrett.
4. Automotive Engines / Srinivasan.
5. A Text Book of Automobile Engineering By Khalil U Siddiqui New Age International.
6. Automobile Engineering by Dr. Kripal Singh- Vol. 1 and 2.

Course Outcomes:

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

1. List different types of Engine and their classifications.
2. Judge firing order for multi-cylinder engines for igniting of fuels.
3. Develop concept and define working of Automobile Engine cooling and lubrication system.
4. To understand the cooling system, ignition system of the IC engines
5. Transmission of the power transmission system of automobiles, suspension system of the automobiles including the rigid axle of the automobiles.
6. Mechanical braking system of the automobiles
7. Types of the steering mechanisms such as ackerman and davis.
8. Emission from automobiles.

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(R16MED1118) FINITE ELEMENT METHODS

Objective

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

UNIT - I

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

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

UNIT – II:

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

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

UNIT – III:

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

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

Two dimensional four noded Isoparametric elements and problems.

UNIT – IV:

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

UNIT – V:

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

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

TEXT BOOKS:

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

REFERENCE BOOKS :

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

Outcomes :

After taking this course the students should be able to

- to obtain an understanding of the fundamental theory of the FEA method;
- to develop the ability to generate the governing FE equations for systems governed by partial differential equations;
- to understand the use of the basic finite elements for structural applications using truss, beam, frame, and plane elements; and
- to understand the application and use of the FE method for heat transfer problems.
- to demonstrate the ability to create models for trusses, frames, plate structures, machine parts, and components using ANSYS general-purpose software;
- to model multi-dimensional heat transfer problems using ANSYS;
- to demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes;
- to develop a basic understanding of the limitations of the FE method and understand the possible error sources in its use.
- To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

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(R16MED1119) REFRIGERATION AND AIR CONDITIONING

Course Objectives:

1. The purpose of this course is to impart adequate knowledge in both practice and theory.
2. The course structures covers various types of Refrigeration Systems to familiarize the students with the fundamentals of Refrigeration and Air Conditioning Systems.
3. After the completion of this course the students will be acquainted with the operation and maintenance/repair of different components of Refrigeration Systems.

UNIT – I

Introduction to Refrigeration: -Basic concepts - Unit of refrigeration and C.O.P-refrigerators-heat pump- carnot refrigerator-applications of refrigerator – Vapour compression refrigeration- Ideal cycle – effect of sub cooling of liquid- super heating of vapour-deviations of practical (actual cycle) from ideal cycle- construction and use of P-H chart- problems.

UNIT – II

Components :

Compressors –classification – Working – Advantages and Disadvantages.

Condensers – classification – Working Principles

Evaporators – classification – Working Principles

Expansion devices – Types – Working Principles

UNIT III:

Vapor Absorption refrigeration – Description and working of ammonia – water, Li Br – water system – Calculation of HCOP, Principle and operation of three fluid vapour absorption refrigeration system.

Air refrigeration- Bell Coleman cycle – open and dente air system - ideal and actual refrigeration – applications – steam jet refrigeration system – working principle – basic operation

UNIT – IV:

Introduction to Air Conditioning:

Psychometric Properties & Processes – Sensible and latent heat loads – Characterization – Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, ASHF, ESHF and ADP.

Concept of human comfort and effective temperature –Comfort Air conditioning – Industrial air conditioning and Requirements – Air conditioning Load Calculations.

UNIT – V:

Air Conditioning systems: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, deodorants, fans and blowers.

Heat Pump – Heat sources – different heat pump circuits – Applications.

TEXT BOOKS:

1. Refrigeration and Air Conditioning / CP Arora / TMH.
2. A Course in Refrigeration and Air Conditioning / SC Arora & Domkundwar / Dhanpatrai.

REFERENCE BOOKS:

1. Principles of Refrigeration /Dossat / Pearson Education.
2. Basic Refrigeration and Air-Conditioning/ Ananthanarayanan / TMH.
3. Refrigeration and Air Conditioning/ Manohar Prasad/ New Age.
4. Refrigeration and Air Conditioning/Ahmadul Ameen/PHI.

Course Outcomes:

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

1. Explain different types of Basic Refrigeration cycles and its applications in multi compressor and multi evaporator systems.
2. Describe the methods for low temperature refrigeration.
3. Propose the selection and design of different components of Refrigeration systems.
4. Describe functioning of different kind of heat energy operated vapour absorption systems.
5. Propose the selection and application of suitable/eco-friendly refrigerants.

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(R16MED1120) DESIGN OF MACHINE MEMBERS – II

Objectives:

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

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

UNIT – I

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

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

UNIT – II

Design of IC Engine Parts :

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

UNIT – III

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

UNIT – IV

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

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

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

UNIT – V

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Course Outcome

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

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

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(R16MED1121) HEAT TRANSFER

Course Objectives:

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

UNIT – I

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

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

UNIT – II

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

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

UNIT – III

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

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

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

UNIT – IV

Heat Transfer With Phase Change:

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

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

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

UNIT V

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

TEXT BOOKS :

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

REFERENCE BOOKS:

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

Course Outcome

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

1. Formulate and predict heat conduction problems with and without heat generation in composite walls and extended surfaces subjected to convective boundaries. Analyze 1D unsteady and 2D steady conduction problems.
2. Develop concept of boundary layer formation over heated surfaces during forced and free convection, formulation of momentum and energy equations of the solution by approximate method.
3. Study of heat transfer with phase change.
4. Study of the heat exchanges.

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(R16MED1117) INDUSTRIAL MANAGEMENT (OPEN ELECTIVE)

Objectives:
This course is intended to familiarise the students with the framework for the managers and leaders available for understanding and making decisions relating to issues related organisational structure, production operations, marketing, Human resource Management, product management and strategy.

UNIT I:
Introduction to Management: Entrepreneurship and organization - Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management

UNIT II:
Designing Organizational Structures: Departmentation and Decentralization, Types of Organization structures - Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

UNIT III:
Operations Management: Objectives- product design process- Process selection-Types of production system(Job, batch and Mass Production),-Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts-Design of product layout- Line balancing(RPW method)
Value analysis-Definition-types of values- Objectives- Phases of value analysis- Fast diagram

UNIT IV:
Work Study: Introduction – definition – objectives – steps in work study – Method study – definition – objectives – steps of method study. Work Measurement – purpose – types of study – stop watch methods – steps – key rating – allowances – standard time calculations – work sampling.
Statistical Quality Control: variables-attributes, Shewart control charts for variables- χ chart, R chart, -Attributes-Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

UNIT V:
Job Evaluation : methods of job evaluation – simple routing objective systems – classification method – factor comparison method – point method – benefits of job evaluation and limitations.
Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems)

TEXT BOOKS:
1. Industrial Engineering and Management/O.P. Khanna/Khanna Publishers.
2. Industrial Engineering and Management Science/T.R. Banga and S.C.Sarma/Khanna Publishers.

REFERENCE BOOKS:
1. Motion and Time Study by Ralph M Barnes/ John Willey & SonsWork Study by ILO.
2. Human factors in Engineering & Design/Ernest J McCormick / TMH.

3. Production & Operation Management /Paneer Selvam /PHI.
4. Industrial Engineering Management/NVS Raju/Cengage Learning.
5. Industrial Engineering Hand Book /Maynard.
6. Industrial Engineering Management / RaviShankar/ Galgotia.

Course Outcome

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

1. List, justify and interpret productivity models in manufacturing and service organization.
2. Judge product development and industrial process design.
3. Predict facility location and network models.
4. Interpret and solve data from aggregate output planning models. Knowledge of human factors in engineering and various jobs designs.
5. Select and analyze an inventory control model based upon given data. Understanding of manufacturing resource and just-in-time planning.
6. Predict and control the quality of an end product.
7. Design and model industrial systems using linear and non-linear programming approaches.
8. To understand the methods of job evaluation, project management by using CPM and PERT.

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	4	**-/-/-**	**4**

(R16CIV1132) DISASTER MANAGEMENT
(OPEN ELECTIVE)

Objectives :

This self-study course will meet the needs of people involved in disaster management for both sudden-onset natural disasters (i.e., earthquakes, floods, hurricanes) and slow-onset disasters (i.e., famine, drought). This course is designed for government personnel, representatives of private voluntary agencies, and other individuals interested in disaster management.

Unit-I

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches.

Unit –II

Types of Environmental hazards & Disasters: Natural hazards and Disasters - Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards-Endogenous Hazards - Exogenous Hazards –

Unit –III

Endogenous Hazards - Volcanic Eruption – Earthquakes – Landslides - Volcanic Hazards/ Disasters - Causes and distribution of Volcanoes - Hazardous effects of volcanic eruptions - Environmental impacts of volcanic eruptions - Earthquake Hazards/ disasters - Causes of Earthquakes - Distribution of earthquakes - Hazardous effects of - earthquakes - - Earthquake Hazards in India - - Human adjustment, perception & mitigation of earthquake.

Unit –IV

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters.

Infrequent events: Cyclones – Lightning – Hailstorms.

Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes , distribution human adjustment, perception & mitigation) Cumulative atmospheric hazards/ disasters : - Floods- Droughts-Cold waves- Heat waves Floods:- Causes of floods- Flood hazards India-Flood control measures (Human adjustment, perception & mitigation) Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures- Extra Palnetary Hazards/ Disasters- Man induced Hazards / Disasters- Physical hazards/ Disasters-Soil Erosion.

Soil Erosion:— Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion.

Chemical hazards/ disasters:— Release of toxic chemicals, nuclear explosion- Sedimentation processes Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation

Biological hazards/ disasters:- Population Explosion.

Unit –V

Emerging approaches in Disaster Management- Three Stages

1. Pre- disaster stage (preparedness)
2. Emergency Stage
3. Post Disaster stage-Rehabilitation

TEXT BOOKS:

4. Disaster Mitigation: Experiences And Reflections by Pardeep Sahni.
5. Natural Hazards & Disasters by Donald Hyndman & David Hyndman – Cengage Learning.

REFERENCES

1. R.B.Singh (Ed) Environmental Geography, Heritage Publishers New Delhi,1990.
2. Savinder Singh Environmental Geography, Prayag Pustak Bhawan, 1997.
3. Kates,B.I & White, G.F The Environment as Hazards, oxford, New York, 1978.
4. R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000.
5. H.K. Gupta (Ed) Disaster Management, Universiters Press, India, 2003.
6. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED), University of Tokyo, 1994.
7. Dr. Satender , Disaster Management t in Hills, Concept Publishing Co., New Delhi, 2003.
8. A.S. Arya Action Plan For Earthquake,Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994.
9. R.K. Bhandani An overview on Natural & Man made Disaster & their Reduction,CSIR, New Delhi.
10. M.C. Gupta Manuals on Natural Disaster management in India, National Centre for Disaster Management,IIPA, New Delhi, 2001.

Outcomes

After completing this session, you will be able to

- Affirm the usefulness of integrating management principles in disaster mitigation work
- Distinguish between the different approaches needed to manage pre- during and post- disaster periods
- Explain the process of risk management
- Relate to risk transfer

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(R16CIV1123) INTELLECTUAL PROPERTY RIGHTS
(OPEN ELECTIVE)

Course Objectives:

ensure adequate and effective protection, including legislation, administration and enforcement of intellectual property rights, foster harmonization of intellectual property rights systems in the strengthen public awareness activities and promote dialogue on emerging intellectual property policy issues, with a view to further improve intellectual property rights protection and use of the intellectual property rights systems for the social and economic benefit of members.

UNIT – I

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

UNIT – II

Trade Marks : Purpose and function of trade marks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights : Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents : Foundation of patent law, patent searching process, ownership rights and transfer.

UNIT – IV

Trade Secrets : Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition : Misappropriation right of publicity, False advertising.

UNIT – V

New development of intellectual property: new developments in trade mark law ; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, international development in trade secrets law.

TEXT BOOKS & REFERENCES:

1. Intellectual property right, Deborah. E. Bouchoux, cengage learing.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tate Mc Graw Hill Publishing company ltd.,

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(R16HAS1105) HUMAN VALUES AND PROFESSIONAL ETHICS (OPEN ELECTIVE)

Objectives : This introductory course input is intended

a. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

b. To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.

c. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with Nature.

Unit I:

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Understanding the need, basic guidelines, content and process for Value Education. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit II:

Understanding Harmony in the Human Being - Harmony in Myself! : Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

Unit III:

Understanding Harmony in the Family and Society- Harmony in Human -Human Relationship : Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; **Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.** Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!

Unit IV:

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence : Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

Unit V:

Implications of the above Holistic Understanding of Harmony on Professional Ethics : Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics:

a. Ability to utilize the professional competence for augmenting universal human order,
b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order:

a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers.
b. At the level of society: as mutually enriching institutions and organizations .

TEXT BOOK

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics
2. Prof. KV Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications,3rd Edition.

REFERENCE BOOKS

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA.
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
4. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991.
5. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
6. A.N. Tripathy, 2003, Human Values, New Age International Publishers.
7. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethichs (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

Relevant CDs, Movies, Documentaries & Other Literature:

1. Value Education website, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story

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B.Tech. - III Year – II Semester	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(R16MED1207) HEAT TRANSFER LAB

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

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	-	**-/3/-**	**2**

(R16HAS1202) ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

Introduction

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

Syllabus:

The following course content to conduct the activities is prescribed for the Advanced Communication Skills (ACS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/**PPTs** and written presentations through posters/projects/reports/ e-

mails/assignments etc.

5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

Minimum Requirement:
The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 35 students in the lab:

- **Spacious room with appropriate acoustics.**
- **Round Tables with movable chairs**
- **Audio-visual aids**
- **LCD Projector**
- **Public Address system**
- **P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ**
- **T. V, a digital stereo & Camcorder**
- **Headphones of High quality**

Prescribed Lab Manual: A book titled ***A Course Book of Advanced Communication Skills (ACS) Lab*** published by Universities Press, Hyderabad.

Suggested Software:
The software consisting of the prescribed topics elaborated above should be procured and used.

- **Oxford Advanced Learner's Compass**, 7th Edition
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech
- **TOEFL & GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **The following software from 'train2success.com'**
  - **Preparing for being Interviewed**
  - **Positive Thinking**
  - **Interviewing Skills**
  - **Telephone Skills**
  - **Time Management**

Books Recommended:

1) Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2) Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3) Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
4) Business and Professional Communication: Keys for Workplace Excellence. Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications. 2011.
5) The Basics of Communication: A Relational Perspective. Steve Duck & David T. McMahan. Sage South Asia Edition. Sage Publications. 2012.
6) English Vocabulary in Use series, Cambridge University Press 2008.
7) Management Shapers Series by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.

8) Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
9) Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
10) Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.
11) Job Hunting by Colm Downes, Cambridge University Press 2008.
12) Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.
13) English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hil 2009.
14) Books on TOEFL/GRE/GMAT/CAT/ IELTS by Barron's/DELTA/ Cambridge University Press.
15) International English for Call Centres by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

DISTRIBUTION AND WEIGHTAGE OF MARKS:

Advanced Communication Skills Lab Practicals*:*

1. The practical examinations for the ACS Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the English Language lab sessions, there shall be continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned, by inviting the External Examiner from outside. In case of the non-availability of the External Examiner, other teacher of the same department can act as the External Examiner.

Mini Project: As a part of Internal Evaluation

1. Seminar/ Professional Presentation

2. A Report on the same has to be prepared and presented.

**** Teachers may use their discretion to choose topics relevant and suitable to the needs of students.***

**** Not more than two students to work on each mini project.***

**** Students may be assessed by their performance both in oral presentation and written report.***

Outcomes

- Accomplishment of sound vocabulary and its proper use contextually.
- Flair in Writing and felicity in written expression.
- Enhanced job prospects.
- Effective Speaking Abilities

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(R16MTH1106) OPERATIONS RESEARCH

Objectives :
Students will be exposed to allocation problem, Linear Programming, Assignment, Theory of games, Inventory, Waiting Lines and Dynamic Programming.

UNIT – I
Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.
Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method.
UNIT – II
Transportation Problem – Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.
Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem- Traveling Salesman problem.
UNIT – III
Sequencing – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines
Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.
UNIT – IV
Theory of Games: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.
Inventory: Introduction – Single item, Deterministic models – Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand may be discrete variable or continuous variable – Single Period model and no setup cost.
UNIT – V
Waiting Lines: Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.
Dynamic Programming:
Introduction – Terminology- Bellman's Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem.
Simulation: Introduction, Definition, types of simulation models, Steps involved in the simulation process- Advantages and disadvantages-applications of simulation to queuing and inventory.

TEXT BOOKS :
1. Operations Research /J.K.Sharma 4e. /MacMilan.
2. Introduction to O.R/Hillier & Libermann/TMH.

REFERENCE BOOKS :
1. Introduction to O.R /Taha/PHI.
2. Operations Research/ NVS Raju/ SMS Education/3rd Revised Edition.
3. Operations Research /A.M.Natarajan, P.Balasubramaniam, A. Tamilarasi/Pearson Education.

4. Operations Research / Wagner/ PHI Publications.
5. Operations Research/M.V. Durga Prasad, K, Vijaya Kumar Reddy, J. Suresh Kumar/ Cengage Learning.

Course Outcomes:

After taking this course the students should be able to

1. Identify necessity and development of mathematical models for various industries.
2. Describe basic optimization and simulation techniques applied to various industries.
3. Recall investment analysis and game theory.
4. Propose a queuing model based upon given data.

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(R16MED1125) POWER PLANT ENGINEERING

Course Objectives:

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

UNIT – I

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

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

UNIT – II

Internal Combustion Engine Plant:

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

UNIT – III

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

UNIT – IV

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

UNIT – V

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

TEXT BOOKS :

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

REFERENCES :

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

Course Outcomes:

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

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(R16MED1126) CAD/CAM

Objectives :

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

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

Topics:

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

UNIT – I

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

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

UNIT-II

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

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

UNIT – III

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

UNIT – IV

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

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

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

UNIT – V

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

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

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

TEXT BOOKS:

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

REFERENCE BOOKS :

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

Outcomes:

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

1. To describe the fundamental theory and concepts of the CAD/CAM.
2. Develop the concepts and underlying theory of modeling and the usage of models in different engineering applications.
3. Develop the Presentation skills
4. Compare the different types of modeling techniques and explain the central role solid models play in the successful completion of CAD/CAM-based product development.
5. Develop transformations for 2D geometric modeling.
6. Explain the basic concepts of CNC programming and machining.
7. Describe the principles of Computer Aided Designing systems and the concepts of Geometric modeling, solid modeling, and feature-based design modeling.
8. Create and design mechanical parts and elements in 2D transformations.
9. Distinguish the different CAD/CAM neutral files. Understand the import and export procedure of CAD/CAM electronic neutral files (IGES, STEP,.).
10. Compare and distinguish the difference between the operation and programming of a CNC machine tool using manual programming and the operation and programming of CNC machine tool using CAM systems.
11. Apply both practices (manually and CAM) to develop the G,M, S,T & F code program.
12. To develop APT (automatic program tool) programming.
13. To understand GT, CAPP, MRP, FMS, CAQC & CIM.

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(R16MED1127) INSTRUMENTATION AND CONTROL SYSTEMS

Course Objectives:

- To gain the knowledge of different process instruments,
- To understand dynamic modeling of a physical process using first principles,
- To convert the model to a form amenable to solution and analysis,
- To design various control schemes,
- To apply the control system in various processes.

UNIT – I

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error, Classification and elimination of error.

UNIT – II

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

Measurement of Temperature: Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators..

Measurement of Pressure: Units – classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.

UNIT – III

Measurement of Level: Direct method – Indirect methods – capacitive, ultrasonic, magnetic, cryogenic fuel level indicators – Bubbler level indicators.

Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA) .

Measurement of Speed: Mechanical Tachometers – Electrical tachometers – Stroboscope, Non-contact type of tachometer.

Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle.

UNIT – IV

Stress Strain Measurements: Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, sling psychrometer, Absorption psychrometer, Dew point meter.

Measurement Of Force, Torque And Power: Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT – V

Elements of Control Systems: Introduction, Importance – Classification – Open and loop systems Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems.

TEXT BOOKS:

1. Measurement Systems: Applications & Design / D.S Kumar/Anuradha Agencies.
2. Instrumentation, measurement & analysis /B.C.Nakra & K.K.Choudhary/ TMH.

REFERENCE BOOKS:

1. Principles of Industrial Instrumentation and Control Systems/ Chennakesava R Alavala/ Cengage Learning.
2. Instrumentation and Control systems/ S.Bhaskar/ Anuradha Agencies.
3. Experimental Methods for Engineers / Holman/McGraw Hill.
4. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.
5. Mechanical Measurements / Sirohi and Radhakrishna / New Age.
6. Instrumentation & Mech. Measurements /A.K. Tayal /Galgotia Publications.

Course Outcomes:

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

- Knowledge of field instrumentations
- Dynamic modeling and system behavior study
- Design of controllers
- Application of control systems in processes.
- Study of measurement of displacement, temperature, pressure, flow measurements, level measurements, speed, acceleration, vibration, stress and strain, humidity, force, torque and power

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(R16MED1128) ROBOTICS
(ELECTIVE - I)

Objectives:

1) To acquire the knowledge on advanced algebraic tools for the description of motion.
2) To develop the ability to analyze and design the motion for articulated systems.
3) To develop an ability to use software tools for analysis and design of robotic systems.

UNIT – I

Introduction**,** Automation and Robotics – An over view of Robotics – classification by coordinate system and control systems - **Components of the Industrial Robotics:** Degrees of freedom – End effectors: Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General consideration on gripper selection and design, Robot actuator and sensors.

UNIT – II

Motion Analysis: Basic rotation matrices – Composite rotation matrices – Euler Angles – Equivalent Angle and Axis – Homogeneous transformation – Problems.

Manipulator Kinematics: D-H notations - Joint coordinates and world coordinates - Forward and inverse kinematics – problems.

UNIT – III

Differential Kinematics: Differential Kinematics of planar and spherical manipulators - Jacobians – problems.

Robot Dynamics: Lagrange – Euler formulations – Newton-Euler formulations – Problems on planar two link manipulators.

UNIT IV

Trajectory Planning: Joint space scheme – cubic polynomial fit – Avoidance of obstacles – **Types of motion:** Slew motion - joint interpolated motion – straight line motion – problems.

Robot actuators and Feed back components: Actuators: Pneumatic.

UNIT V

Robot Application in Manufacturing: Material handling - Assembly and Inspection – Work cell design, work volume, Robot screan.

TEXT BOOKS :

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Introduction to Robotic Mechanics and Control / JJ Craig/ Pearson/ 3rd edition.

REFERENCES :

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klaftez/ Prentice Hall.
3. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.

4. Robot Dynamics & Control/Mark W. Spong and M. Vidyasagar / John Wiley & Sons (ASIA) Pvt. Ltd.
5. Robotics and Control / Mittal R K & Nagrath I J / TMH.

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

1) Be able to use matrix algebra for computing the kinematics of robots.
2) Be able to calculate the forward kinematics and inverse kinematics of serial and parallel robots.
3) Be able to calculate the Jacobian for serial and parallel robot.
4) Be able to do the path planning for a robotic system.
5) Study of different numerical methods.

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(R16MED1129) MECHANICAL VIBRATIONS
(ELECTIVE - I)

Course Objectives:

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

UNIT- I:

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

UNIT- II:

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

UNIT-III:

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

Vibration measuring instruments: Vibrometers, velocity meters & accelerometers

UNIT- IV:

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

UNIT V:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Course Outcomes:

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

1. Discuss the importance of vibrations in mechanical design of machine parts that operate in vibratory conditions.
2. Compose linear vibratory models of dynamic systems with changing complexities (SDOF, MDOF), and of real life engineering systems.
3. Formulate free and forced (harmonic, periodic, non-periodic) vibration response of single

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(R16MED1130) MECHATRONICS
(ELECTIVE - I)

UNIT-I

Mechatronics systems, elements, levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion , force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT-II

Solid state electronic devices, PN junction diode, BJT, FET, DIA and TRIAC. Analog signal conditioning, amplifiers, filtering. Introduction to MEMS & typical applications.

UNIT-III

Hydraulic and pneumatic actuating systems, Fluid systems, Hydraulic and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems: Mechanical actuating systems and electrical actuating systems.

UNIT-IV

Digital electronics and systems, digital logic control, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT-V

System and interfacing and data acquisition, DAQS , SCADA, A to D and D to A conversions; Dynamic models and analogies, System response. Design of mechatronics systems & future trends.

TEXT BOOKS:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran & GK Vijaya Raghavan/WILEY India Edition/2008
2. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/ W Bolton/ Pearson Education Press/3rd edition, 2005.

REFERENCES:

1. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
3. Mechatronics System Design / Devdas shetty/Richard/Thomson.
4. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
5. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition, Pearson, 2012 W. Bolton
6. Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlsevier, 2006 Indian print.

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B.Tech. - IV Year – I Semester	L	T/P/D	C
	4	-/-/-	4

(R16MED1131) MECHANICS OF COMPOSITE MATERIALS (ELECTIVE - I)

UNIT-I

Introduction to Composite Materials: Introduction ,Classification Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber-Reinforced Composites and nature-made composites, and applications .

UNIT-II

Reinforcements: Fibers- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibers. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

UNIT-III

Macro Mechanical Analysis of a Lamina: Introduction, Definitions Stress, Strain, Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials, Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

UNIT-IV

Macro Mechanical Analysis of Laminates: Introduction , Laminate Code , Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus.

UNIT-V

Failure Analysis of Laminates: Introduction, Special Cases of Laminates, Applications, Failure Criterion for a Laminate.

TEXT BOOKS:

1. Mechanics of Composite Materials/ R. M. Jones/ Mc Graw Hill Company, New York, 1975.
2. Engineering Mechanics of Composite Materials/Isaac and M Daniel/ Oxford University Press, 1994.

REFERENCES:

1. Analysis and performance of fibre Composites/ B. D. Agarwal and L. J. Broutman/ Wiley- Inter science, New York, 1980.
2. Mechanics of Composite Materials/ Second Edition (Mechanical Engineering)/ Autar K. Kaw/Publisher: CRC.
3. Analysis of Laminated Composite Structures/ L. R. Calcote/ Van Nostrand Rainfold, New York, 1969.
4. Advanced Mechanics of Composite Materials/ Vasiliev &Morozov/ Elsevier/Second Edition.

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(R16MED1132) UNCONVENTIONAL MACHINING PROCESSES (ELECTIVE - II)

Objectives:

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

UNIT – I : Introduction: Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection. Materials. Applications.

Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

UNIT – II : Abrasive jet machining, Water jet machining and abrasive water jet machining: Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations.

Electro – Chemical Processes : Fundamentals of electro-chemical machining, electro-chemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM – Simple problems for estimation of metal removal rate.

UNIT – III : Thermal Metal Removal Processes : 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, surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM-principle and applications.

UNIT – IV : Generation and control of electron beam for machining, 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-V : Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Chemical machining-principle- maskants – etchants- applications, Shaped Tube Electro Machining, Electro Stream Machining, Magnetic Abrasive Finishing and Magnetic Abrasive Flow Finishing and their working principles, Process parameters, Process Capabilities.

TEXT BOOK:

Advanced machining processes - VK Jain, Allied publishers.

REFERENCES :

1. Modern Machining Process - Pandey P.C. and Shah H.S., TMH.
2. New Technology - Bhattacharya A, The Institution of Engineers, India 1984.
3. Unconventional Machining Processes - C. Elanchezhian,, B. Vijaya Ramnath and M Vijayan, Anuradha Publications, 2005.

4. Unconventional Manufacturing Processes – M.K. Singh, New Age International Publishers.

Outcomes:

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

1. Understand the basic techniques of unconventional machining processes
2. Understand the economical aspects of unconventional machining
3. Understand the need and type of material to machined by unconventional methods.
4. Ability to extend the knowledge of unconventional machining methods to various industries such as aerospace, nuclear and defense industries.
5. Various unconventional machining methods are categorized based on their energies such as Mechanical, Electro Chemical, Electro Thermal and chemical energies.
6. Prediction of the processes for thermal EDM, LBM, PAM, WEDM and EBM.
7. Selection of the tool material and machining process parameters
8. Understanding of micro finishing process such as Magnetic Abrasive finishing, Shaped tube electro stream machining, Magnetic Abrasive Flow Finishing

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(R16MED1133) CNC TECHNOLOGY
(ELECTIVE - II)

Objectives:

- Understand basic features of NC and CNC Machines and their Design Considerations.
- To study various system devices hardware and software interpolations.
- To know various tooling systems used in CNC Machines.
- Understand both Manual and Computer Aided Programming for Generating Various Contours.
- To study about the DNC systems and Adaptive Control used for various machining process.

UNIT I:

Features of NC Machines, Fundamentals of numerical control, advantage of NC systems, classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, Features of NC Machine Tools, design consideration of NC machine tool, methods of improving machine accuracy.

UNIT II:

CNC Machines Elements: Machine Structure- Guideways - feed drives-spindles - spindle bearings.
System Devices: Drives, feedback devices, counting devices.
Interpolators for manufacturing systems: DDA integrator, DDA hardware interpolators, CNC software interpolators.

UNIT III:

Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers.

UNIT IV:

NC Part Programming: Manual programming-Basic concepts, Point-to-Point contour programming, canned cycles, parametric programming.
Computer-Aided Programming: General information, APT programming, Examples APT programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors .Introduction to CAD/CAM software, Automatic Tool Path generation.

UNIT V:

DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, Adaptive control with constraints, Adaptive control of machining processes like turning, grinding.

TEXT BOOKS:

1. Computer Control of Manufacturing Systems - Yoram Koren ,Tata Mc Graw Hill, 2009.
2. Computer Aided Manufacturing - Elanchezhian, Sunder Selvan and Shanmuga Sunder, University Science Press, Second edition.

REFERENCE BOOKS:

1. Machining Tools Hand Book Vol 3, (Automation & Control)/ Manfred Weck / John Wiley and Sons, 1984.
2. Mechatronics – HMT, TMH.
3. Computer Numerical Control-Operations and Programming – Jon Stenerson and Kelly Curron Pul, 3rd Edition.

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(R16MED1134) AUTOMATION IN MANUFACTURING
(ELECTIVE - II)

UNIT – I

Introduction: Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and too changing and machine tool control transfer the automaton.

UNIT – II

Automated flow lines : Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration.

Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT – III

Assembly system and line balancing : Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT –I V

Automated material handling : Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems.

Automated storage systems, Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT – V

Fundamentals of Industrial controls: Review of control theory, logic controls, sensors and actuators, Data communication and LAN in Manufacturing

Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE.

TEXT BOOK:

1. Automation, Production Systems and Computer Integrated Manufacturing : M.P. Groover 3e./PE/PHI, 2009.

REFERENCES:

1. Computer Aided Manufacturing, Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang, Pearson, 2009.
2. Automation by W. Buekinsham.

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(R16MED1135) DESIGN FOR MANUFACTURING AND ASSEMBLY (ELECTIVE - II)

Objectives:

- To understand various general design rules for manufacturability and criteria for material selection.
- To study various machining process and tolerance aspects in machining.
- To know the design considerations for casting and welding process.
- To understand the conceptual design factors to be considered in forging, extrusion and sheet metal work.
- To study the general design guidelines for manual assembly and development of DFA Methodology.

UNIT I:

Introduction: Design philosophy – Steps in Design process – General Design rules for Manufacturability – Basic principles of designing for economical production – Creativity in design.

Materials: Selection of Materials for design – Developments in Material Technology – Criteria for material selection – Material selection interrelationship with process selection – process selection charts.

UNIT II:

Machining Process: Overview of various machining processes – general design rules for machining - Dimensional tolerance and surface roughness

– Design for Machining ease – Redesigning of components for machining ease with suitable examples, General design recommendations for machined parts

UNIT III:

Metal Casting: Appraisal of various casting processes, Selection of casting process, General design considerations for casting – casting tolerances – Use of Solidification Simulation in casting design – Product design rules for sand casting.

Metal Joining: Appraisal of various welding processes, Factors in design of weldments – General design guidelines – pre and post treatment of welds – Effects of thermal stresses in weld joints – Design of brazed joints.

UNIT IV:

Forging: Design factors for forging – Closed die forging design – parting lines of dies – Drop forging die design – General design recommendations

Extrusion, Sheet Metal Work: Design guidelines for Extruded sections - Design principles for Punching, Blanking, Bending, Deep Drawing – Keeler Goodman Forming Limit Diagram – Component Design for Blanking.

UNIT V:

Design for Assembly: General design guidelines for Manual Assembly-Development of Systematic DFA Methodology- Assembly Efficiency-Classification System for Manual handling- Classification System for Manual Insertion and Fastening- Effect of part symmetry on handling time-.

TEXT BOOK:

1. Product design for Manufacture and Assembly - Geoffrey Boothroyd, Peter Dewhurst and W.A. Knight, CRC Press.

REFERENCE BOOKS:

1. Product design and Manufacturing - A.K Chitale and R.C Gupta, Prentice – Hall of India, New Delhi, 2003.
2. Design and Manufacturing - Surender Kumar & Goutham Sutradhar, Oxford & IBH Publishing Co. Pvt .Ltd., New Delhi, 1998.
3. Product Design- Kevin Otto and Kristin Wood, Pearson Education.

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(R16MED1123) NANOTECHNOLOGY
(ELECTIVE - II)

Objective:

Nano Technology is one of the core subjects of multidisciplinary nature. This has extensive applications in the field of energy, electronics, Biomedical Engg. Etc. Built to specifications by manufacturing matter on the atomic scale, the Nano products would exhibit an order of magnitude improvement in strength, toughness and efficiency. The objective here is impart the basic knowledge in Nano Science and Technology.

Unit-I:

Introduction: History and Scope, Can Small Things Make a Big Difference? Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges and Future Prospects.

Unit-II:

Unique Properties of Nanomaterials: Microstructure and Defects in Nanocrystalline Materials:Dislocations, Twins,stacking faults and voids, Grain

Boundaries, triple and disclinations, **Effect of Nano-dimensions on Materials Behavior:** Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, Enhanced solid solubility, **Magnetic Properties**: Soft magnetic nanocrystalline alloy, Permanent magnetic nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties and Mechanical Properties.

Unit-III:

Synthesis Routes: Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method ,Self assembly, **Top down approaches:** Mechanical alloying, Nano-lithography, **Consolidation of Nanopowders**: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

Unit-IV:

Tools to Characterize nanomaterials: X-Ray Diffraction (XRD), Small Angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nanoindentation.

Unit-V:

Applications of Nanomaterials: Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nanosensors, Nanocatalysts, Food and Agricultural Industry, Cosmetic and Consumer Goods, Structure and Engineering, Automotive Industry, Water- Treatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Defence and Space Applications, Concerns and challenges of Nanotechnology.

TEXT BOOKS:

1. Text Book of Nano Science and Nano Technology – B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, University Press-IIM.
2. Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wley India Edition, 2012.

REFERENCES BOOKS:

1. Nano: The Essentials by T.Pradeep, Mc Graw- Hill Education.
2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira and Daniel L.Schodek.
3. Transport in Nano structures- David Ferry, Cambridge University press 2000
4. Nanofabrication towards biomedical application: Techniques, tools, Application and impact – Ed. Challa S.,S. R. Kumar, J. H. Carola.
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
6. Electron Transport in Mesoscopic systems - S. Dutta, Cambridge University press.

Outcome of the study:

The present syllabus of "Introduction to Nano Technology" will give insight into many aspects of Nanoscience, technology and their applications in the prospective of materials science.

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	-	**-/3/-**	**2**

(R16MED1208) COMPUTER AIDED DESIGN & MANUFACTURING LAB

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances.

2. Part Modeling: Generation of various 3D Models through Protrusion, revolve, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling and Assembly Modeling. Study of various standard Translators. Design of simple components.

3. Determination of deflection and stresses in 2D and 3D trusses and beams.

4. Determination of deflections, principal and Von-mises stresses in plane stress, plane strain and Axi-symmetric components.

5. Determination of stresses in 3D and shell structures (at least one example in each case)

6. Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.

7. Study state heat transfer analysis of plane and axi-symmetric components.

8. Development of process sheets for various components based on Tooling and Machines.

9. Development of manufacturing defects and tool management systems.

10. Study of various post processors used in NC Machines.

11. Development of NC code for free form and sculptured surfaces using CAM software.

12. Machining of simple components on NC lathe and Mill by transferring NC Code / from CAM software.

13. Quality Control and inspection.

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	-	-/3/-	2

(R16MED1209) PRODUCTION DRAWING PRACTICE AND INSTRUMENTATION LAB

(A) PRODUCTION DRAWING PRACTICE

UNIT – I

CONVENTIONAL REPRESENTATION OF MATERIALS: conventional representation of parts – screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

Limits, Fits and Tolerances: Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

UNIT – II

FORM AND POSITIONAL TOLERANCES: Introduction and indication of form and position tolerances on drawings, types of run out, total run out and their indication.

UNIT – III

SURFACE ROUGHNESS AND ITS INDICATION: Definition, types of surface roughness indication – Surface roughness obtainable from various manufacturing processes, recommended surface roughness on mechanical components. Heat treatment and surface treatment symbols used on drawings.

UNIT – IV

DETAILED AND PART DRAWINGS: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

UNIT – V

PRODUCTION DRAWING PRACTICE: Part drawings using computer aided drafting by CAD software

TEXT BOOKS:

1. Production and Drawing /K.L. Narayana & P. Kannaiah/ New Age
2. Machine Drawing with Auto CAD/ Pohit and Ghosh, PE

REFERENCES:

1. Geometric dimensioning and tolerancing/James D. Meadows/ B.S Publications
2. Engineering Metrology/ R.K. Jain/Khanna Publications

1. INSTRUMENTATION LAB

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

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	3	**-/1/-**	**3**

(R16MED1136) PRODUCTION PLANNING AND CONTROL

Objectives:

1. To plan production facilities in the best possible manner along with the proper systematic planning of production activities.
2. Providing men, machines, materials etc. of right quality, quantity and also providing them at the right time forms a very important factor and Japanese concepts of the inventory control.
3. To inform, about the difficulties or the various awkward positions expected to crop up later, to the management beforehand.
4. Involves order preparation, process planning or routing concerns, fixation of method of manufacture, scheduling, dispatching, progressing, expediting etc.
5. Involves cost estimation, work measurement, subcontracting, capacity planning and demand forecasting etc.

UNIT-I

Introduction: Definitions – objectives of production planning and control-functions of production planning and control-elements of production control-types of production- organization of production planning and control – internal organizations department

UNIT-II

Forecasting – Importance of forecasting – types of forecasting, their uses-general principles of forecasting techniques- Qualitative methods and quantitative methods.

UNIT-III

Inventory management – Functions inventory- Relevant inventory cost- ABC analysis- VED Analysis- EOQ model – Inventory control systems – P- Systems and Q – Systems

Introduction to MRP And ERP, LOB(Line of balance), JIT inventory, Japanese concepts.

UNIT- IV

Routing – Definition – routing procedure- Route sheets – Bill of material-factors affecting routing procedure. Schedule – definition – difference with loading.

Scheduling polices – techniques, standard scheduling methods- job shop, flow shop,.

Line balancing, aggregate planning- methods for aggregate planning- Chase planning, expediting, control aspects.

UNIT-V

Dispatching – Activities of dispatcher- Dispatching procedure - follow up – definition – reasons for existence of functions – types of follow up, applications of computer in production planning and control

TEXT BOOKS:

1) Production Planning and Control/ M.Mahajan/ Dhanpati rai & Co.
2) Production Planning and Control/ Jain & Jain/ Khanna publications

REFRENCE BOOKS :

1) Production Planning and Control- Text & cases/ SK Mukhopadhyaya /PHI.
2) Production and operations Management/ R.Panneer Selvam/PHI.
3) Operations Management/Chase/PHI.
4) Operations management/ Heizer/Pearson.
5) Production and Operations Management(Theory and Practice)/Dipak Kumar Bhattacharyya/University Press.
6) Operations Management/S.N. Chary/TMH.

Course Outcomes

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

1. The student will be able to help in the design of production/operating system
2. The student will be able to develop forecasts using forecasting techniques and choose a location
3. The student will be able to choose a facility layout and perform work measurement
4. The student will be able to explain capacity planning, materials management and inventory management .
5. The student will be able to explain the master production schedule, shop floor planning and control and material management.

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3	-/1/-	3

(R16CSE1142) ARTIFICIAL NEURAL NETWORKS (ELECTIVE - III)

UNIT- I

Introduction - what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process – Error Correction learning, Memory based learning, Hebbian learning, Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.

UNIT- II

Back Propagation: back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.

UNIT- III

Single Layer Perceptrons: Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perceptron

– convergence theorem, Relation between perceptron and Bayes classifier for a Gaussian Environment

Multilayer Perceptron – Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection.

UNIT- IV

Self Organization Maps: Two basic feature mapping models, Self organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification.

UNIT- V

Neuro Dynamics: Dynamical systems, stability of equilibrium states, attractors, neuro dynamical models, manipulation of attractors as a recurrent network paradigm

Hopfield Models – Hopfield models, computer experiment

TEXT BOOK:

1. Neural networks: A comprehensive foundation/ Simon Hhaykin/ PHI.

REFERENCES:

1) Artificial neural networks/ B.Vegnanarayana/PHI.
2) Neural networks in Computer intelligence/ Li Min Fu/ TMH/2003.
3) Neural networks/ James A Freeman David M S kapura/ Pearson education/2004.
4) Introduction to Artificial Neural Systems/Jacek M. Zurada/JAICO Publishing House Ed. 2006.

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(R16HAS1107) TOTAL QUALITY MANAGEMENT
(ELECTIVE - III)

UNIT - I

Introduction, The concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture and management systems.

Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT -II

Customer Focus and Satisfaction: Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships.

Bench Marking: Evolution of Bench Marking, meaning of bench marking, benefits of bench marketing, the bench marking procedure, pitfalls of bench marketing.

UNIT- III

Organizing for TQM: The systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles, seven Tools of TQM: Startification, check sheet, Scatter diagram, lshikawa diagram, paneto diagram, Kepner &Tregoe Methodology.

UNIT- IV

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management.

UNIT -V

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQC Q- 90. Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

TEXT BOOK:

1) Total Quality Management / Joel E.Ross/Taylor and Franscis Limited.
2) Total Quality Management/P.N.Mukherjee/PHI.

REFERENCE BOOKS:

1) Beyond TQM / Robert L.Flood.
2) Statistical Quality Control / E.L. Grant.
3) Total Quality Management:A Practical Approach/H. Lal.
4) Quality Management/Kanishka Bedi/Oxford University Press/2011.
5) Total Engineering Quality Management/Sunil Sharma/Macmillan.

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(R16MED1138) MAINTENANCE AND SAFETY ENGINEERING (ELECTIVE - III)

UNIT-I

Introduction, Need for Maintenance, Facts and Figures, Modern Maintenance, Problem and Maintenance Strategy for the 21st Century, Engineering Maintenance Objectives and Maintenance in Equipment Life Cycle, Terms and Definitions.

Maintenance Management and Control: Maintenance Manual, Maintenance, Facility Evaluation, Functions of Effective Maintenance Management, Maintenance Project Control Methods, Maintenance Management Control Indices.

UNIT-II

Types of Maintenance: Preventive Maintenance, Elements of Preventive, Maintenance Program, Establishing Preventive Maintenance Program PM Program Evaluation and Improvement, PM Measures, PM Models, Corrective Maintenance, Corrective Maintenance Types, Corrective Maintenance Steps and Downtime Components, Corrective Maintenance Measures, Corrective Maintenance Models.

Inventory Control In Maintenance: Inventory Control Objectives and Basic Inventory Decisions, ABC Inventory Control Method, Inventory Control Models Two-Bin Inventory Control and Safety Stock, Spares Determination Factors Spares Calculation Methods

UNIT- III

Quality and Safety In Maintenance: Needs for Quality Maintenance Processes, Maintenance Work Quality, Use of Quality Control Charts in Maintenance Work Sampling, Post Maintenance Testing, Reasons for Safety Problems in Maintenance, Guidelines to Improve Safety in Maintenance Work, Safety Officer's Role in Maintenance Work, Protection of Maintenance Workers.

Maintenance Costing: Reasons for Maintenance Costing, Maintenance Budget Preparation Methods and Steps, Maintenance Labor Cost Estimation, Material Cost Estimation, Equipment Life Cycle Maintenance Cost Estimation, Maintenance Cost Estimation Models.

UNIT-IV

Reliability, Reliability Centered Maintenance, RCM: Goals and Principles, RCM Process and Associated Questions, RCM Program Components

Effectiveness Measurement Indicators, RCM Benefits and Reasons for Its Failures, Reliability Versus Maintenance and Reliability in Support Phase, Bathtub Hazard Rate Concept, Reliability Measures and Formulas, Reliability Networks, Reliability Analysis Techniques.

UNIT-V

Maintainability: Maintainability Importance and Objective, Maintainability in Systems Life Cycle, Maintainability Design Characteristics, Maintainability Functions and Measures, Common Maintainability Design Errors.

TEXT BOOKS

1) Reliability, Maintenance and Safety Engineering/ Dr. A.K.Guptha/ Laxmi Publications.
2) Industrial Safety Management/ L.M. Deshmukh/TMH.

REFERENCES:

1) Maintenance Engineering & Management / R.C.Mishra/ PHI.
2) Reliability Engineering / Elsayed/ Pearson.
3) Engineering Maintenance a modern approach/ B.S Dhallon/ C.R.R Publishers.
4) A Text Book of Reliability and Maintenance Engineering/Alakesh Manna/IK International Publishing House.
5) Plant Maintenance and Reliability Engineering/NVS Raju/Cengage Learning.

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B.Tech. - IV Year – II Semester

L	T/P/D	C
3	-/1/-	3

(R16MED1139) PLANT LAYOUT & MATERIAL HANDLING
(ELECTIVE - III)

Objectives :

1) The student will be knowing by undergoing the plant layout and its types, selection etc.,
2) All types of the material handling equipments and their working principles and its selections

UNIT – I

Introduction- Classification of Layout, Advantages and Limitations of different layouts, Layout design procedures, Overview of the plant layout.

Process layout & Product layout: Selection, specification, Implementation and follow up, comparison of product and process layout.

UNIT – II

Heuristics for Plant layout – ALDEP, CORELAP, CRAFT, Group Layout, Fixed position layout- Quadratic assignment model. Branch and bound method

UNIT – III

Introduction, Material Handling systems, Material Handling principles, Classification of Material Handling Equipment, Relationship of material handling to plant layout.

UNIT – IV

Basic Material Handling systems: Selection, Material Handling method- path, Equipment, function oriented systems.

UNIT – V

Methods to minimize cost of material handling- Maintenance of Material Handling Equipments, Safety in handling Ergonomics of Material Handling equipment. Design, Miscellaneous equipments.

TEXT BOOKS:

1) Operations Management/ PB Mahapatra/PHI.
2) Aspects of Material handling/ Dr. KC Arora & Shinde/ Lakshmi Publications.

REFERENCES:

1) Facility Layout & Location an analytical approach/ RL Francis/ LF Mc Linnis Jr, White/ PHI.
2) Production and Operations Management/ R Panneerselvam/ PHI.
3) Introduction to Material handling/ Ray, Siddhartha/ New Age.
4) Plant Layout and Material Handling/RB Chowdary/Khanna Publishers.
5) Plant Maintenance and Reliability Engineering/NVS Raju/Cengage Learning.

Outcomes of the course:

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

- Identify equipment requirements for a specific process
- Understand the benefit of an efficient material handling system
- Understand what effect process layout has on the material handling system
- Recommend improvements to existing plant layouts from the standpoint of material handling and product flow
- Design flexibility into a plant layout to accommodate changes in product volume or product line.
- Integrate concepts and techniques learned through this course in order to design and efficient plant layout in a team environment

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(R16MED1140) RENEWABLE ENERGY SOURCES
(ELECTIVE - IV)

UNIT – I Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power - Physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, Solar radiation on titled surface, Instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT – II Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Solar Energy Storage and Applications: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications - solar heating/ cooling techniques, solar distillation and drying, Photovoltaic energy conversion.

UNIT – III Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics.

Bio-Mass: Principles of Bio-Conversion, Anaerobic /aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation, and economic aspects.

UNIT – IV Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

OTEC : Principles, utilization, setting of OTEC plants, thermodynamic cycles.

Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, their economics.

UNIT –V Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, Principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principle, faraday's laws, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:

1) Renewable Energy Sources / Twidell & Weir / Taylor and Francis / 2nd Special Indian Edition.
2) Non- conventional Energy Sources / G.D. Rai / Dhanpat Rai and Sons.

REFERENCE BOOKS:

1) Energy Resources Utilization and Technologies / Anjaneyulu & Francis / BS Publications/2012.
2) Principles of Solar Energy / Frank Krieth & John F Kreider / Hemisphere Publications.
3) Non-Conventional Energy / Ashok V Desai / Wiley Eastern.
4) Non-Conventional Energy Systems / K Mittal / Wheeler.
5) Renewable Energy Technologies / Ramesh & Kumar / Narosa.
6) Renewable Energy Resources / Tiwari and Ghosal / Narosa.

Outcomes of the course:

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

1) The student able to understand the renewable energy sources such as principle of solar energy, radiation and working principles, wind energy biomass, geo thermal, Tidel, energy and energy conversion principles.

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B.Tech. - IV Year – II Semester	L	T/P/D	C
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(R16MED1141) JET PROPULSION & ROCKET ENGINEERING
(ELECTIVE - IV)

UNIT-I

Fundamentals of Gas Turbine theory-Thermo dynamic Cycles, open closed and semi-closed – parameters of performances –cycle modifications for improvement of performance.

UNIT - II

JET PROPULSION: Historical sketch-reaction principle – essential features of propulsion devices-Thermal Engines, Classification of – Energy flow thrust, Thrust power and propulsion efficiency-Need for Thermal Jet Engines and applications.

UNIT-III

TURBOPROP AND TURBOJET: Thermo dynamic cycles, plant layout, essential components, principles of operation – performance evaluation. Thrust Augmentation and Thrust reversal-Contrasting with piston Engine Propeller plant.

UNIT-IV

RAMJET: Thermo dynamic Cycle, plant lay-out, essential components – principle of operation - performance evaluation – comparison among atmospheric thermal jet engines – scram jet and pulse jet, elementary treatment.

ROCKET ENGINES: Need for, applications – Basic principles of operation and parameter s of performance – classification ,solid and liquid propellant rocket engines ,advantages, domains of application –propellants – comparison of propulsion systems.

UNIT-V

ROCKET TECHNOLOGY: Flight mechanics, Application Thrust profiles, Acceleration –staging of Rockets, need for – Feed systems, injectors and expansion nozzles – Rocket heat transfer and ablative cooling.

TEXT BOOKS:

1) Gas Turbines and propulsive systems/P.Khajuria & S.P.Dubey/ Dhanpat rai pub.
2) Gas Dynamics & Space Propulsion/ M.C.Ramaswamy / Jaico Publishing House.

REFERENCE BOOKS:

1) Rocket propulsion Elements / Sutton / John Wiley & sons / 7th Edition.
2) Gas Turbines /Cohen, Rogers & Sarvana Muttoo/Addision Wesley & Longman.
3) Gas Turbines/V. Ganesan /TMH.
4) Elements of Gas Turbine Propulsion / Jock D Mattingly /Mc Grill.

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B.Tech. - IV Year – II Semester

L	T/P/D	C
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(R16MED1142) COMPUTATIONAL FLUID DYNAMICS
(ELECTIVE - IV)

UNIT-I

Elementary details in numerical techniques: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition for instability, computational methods for error estimation, convergence of sequences.

Applied Numerical Methods: Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix Inversion, Direct Methods for Matrix inversion, Direct Methods for banded matrices.

UNIT - II

Finite Difference Applications in Heat conduction and Convection – Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modeling: Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT - III

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

UNIT - IV

Review of Equations Governing Fluid Flow and Heat Transfer: Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier-stokes equations.

UNIT-V

Finite volume method: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TEXT BOOKS:

1) Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
2) Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications.

REFERENCES:

1) Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.
2) Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities Press.
3) Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis/Oxford University Press/2nd Edition.

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B.Tech. - IV Year – II Semester

L	T/P/D	C
3	-/1/-	3

(R16MED1147) GAS DYNAMICS
(ELECTIVE - IV)

UNIT-I

Introduction, Concept of continuum and control volume, continuity equation, momentum equation, streamline, steady, one dimensional dynamic equation of a fluid flow with and without friction, energy equation. Basic concepts of compressible flow.

Properties of atmosphere, standard atmosphere, relative pressure, use of air and gas tables. Condition for neglecting compressibility. Compressible flow, acoustic velocity, Mach number, Mach cone, Mach angle.

UNIT-II

Isentropic Flow: Stagnation enthalpy, density, pressure and temperature, local acoustic speed. maximum speed, variation of Compressibility with mach number.

UNIT-III

Variable Area Flow: Criteria for acceleration and deceleration, critical condition, nozzle discharge co-efficient, nozzle efficiency, operation of nozzles under varying backpressures.

Flow in constant area duct: Adiabatic and isothermal- flow calculation of pressure, temperature, density, Mach number relationships. Limiting length of duct for adiabatic and isothermal flow. Fanno line.

Diabatic flow: Flow of perfect gases in constant area duct with heat exchange, density temperature, pressure and mach number relationships. Limiting conditions. Rayleigh line.

UNIT-IV

Wave Phenomenon: Pressure disturbances in compressible fluid, type of shock waves – normal, shock. Pressure –density-velocity-temperature and Mach number relations for a plane normal shock- Shock tube-mach reflection

– thin area prandtl theory.

UNIT-V

Shock intensity- Rayleigh- Pilot and Prandtl- Pitot equation for normal shock. Introduction to oblique shockwaves and hypersonic flow – Fenno flow.

TEXT BOOKS:

1) Gas dynamics through problems/ Zoeb Hussain/ WILEY EASTERN LTD.
2) Fundamentals of Compressible Flow/ S.M. Yahya / New Age International Publishers, 2004.

REFERENCES:

1) Gas dynamics/ E. Radha Krishnan/ P.H.I Publication/4th Edition/2012.
2) Gas Dynamics for engineers / P Balachandran / PHI / Eastern Economy Edition /2012.
3) Gas Dynamics/ H.W. Lipman and A. Rashkho/ John Wiley/ 1963.
4) Gas Dynamics/ Cambel and Jennings/ McGraw Hill/ 1958.
5) Fundamentals of Gas Dynamics / Robert D. Zucker & Oscar Biblarz/ Wiley India / 2nd Edition.
6) Gas Dynamics and Jet Propulsion / S L Somasundaram / New age International Publishers.

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(R16MED1210) INDUSTRY ORIENTED MINI PROJECT

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	-	-/6/-	2

(R16MED1211) SEMINAR

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	-	-/15/-	9

(R16MED1212) PROJECT WORK

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	-	-/-/-	2

(R16MED1213) COMPREHENSIVE VIVA