ACADEMIC REGULATIONS
COURSE STRUCTURE AND
DETAILED SYLLABUS

Mechanical Engineering

B.TECH. FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2013-2014)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous Institute
Approved by AICTE & Affiliated to JNTUH
Accredited by NBA and NAAC with 'A' Grade

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VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
HYDERABAD
An Autonomous Institute
Approved by AICTE & Affiliated to JNTUH
Accredited by NBA and NAAC with 'A' Grade

ACADEMIC REGULATIONS FOR B.TECH. DEGREE COURSE

(Applicable for Students admitted from the academic year 2013-2014)

1. Courses of study

The following courses of study are offered at present for specialization for the B. Tech. Course:

Branch Code	Branch
01	Civil Engineering.
02	Electrical and Electronics Engineering
03	Mechanical Engineering
04	Electronics and Communication Engineering
05	Computer Science and Engineering.
10	Electronics and Instrumentation Engineering
12	Information Technology
24	Automobile Engineering

1.1 Eligibility Criteria for Admission

- The eligibility criteria for admission into engineering programmes shall be as mentioned below:
- The candidate shall be an Indian National / NRI
- The candidate should have completed 16 years of age as on 31st December of the academic year for which the admissions are being conducted.
- The Candidate should have passed the qualifying examination (10+2) or equivalent as on the date of admission

1.1 .1 Seats in each programme in the Institution are classified into **Category A** and **Category B** as per the G.Os.

a) 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 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 candidate shall be admitted into the Third Semester, (2^{nd} year, I^{st} Semester) based on the rank secured by the candidate at Engineering Common Entrance Test (ECET (FDH)) by the Convener, ECET.

2. 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 100 marks for practical subjects.** In addition, an Industry oriented mini-project, Seminar, Comprehensive viva-voce, and Project Work shall be evaluated for **100, 100, 100 and 200 marks** respectively.

ii. For theory subjects the distribution shall be **30 marks for Mid Semester Evaluation** and **70 marks for the End Semester Examination**.

For theory subjects, two mid examinations will be conducted in each Semester as per the academic calendar. Each mid examination is evaluated for 25 marks.

For the Mid-Examination the Distribution of Marks (25 Marks) as follows

Part-A: - 4 Marks (4X1 Marks) Compulsory

6 Marks (3X2 Marks) Compulsory

Part-B:- 15 Marks (3X5 Marks) 3 out of 4 Questions

Assignment Test/Assignment: - Two assignments are to be given to students covering the syllabus of First Mid and Second Mid Examinations respectively and are evaluated for 5 marks each.

The first assignment shall be submitted after first mid examinations and second Assignment should be submitted after second mid examination.

At the end of the Semester, Internal Marks (Maximum 30) for the respective subject is assigned as follows:

(a) 25 marks: 80% from the best performed mid examination and 20% from the other mid examination.

(b) 5 marks: Average of the two assignments/assignment tests

iii. For practical subjects there shall be a continuous evaluation during the Semester for 30 **marks and 70 marks for end examination**. Out of the 30 marks, **day-to-day work in the laboratory shall be evaluated for 10 marks**, and 10 marks for practical examination and 10 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.

B. If any student absent for mid exam due to Medical/Acute illness same may be reported in advance to Head of the Department in writing with a request to reconduct the mid-term examination. The committee consisting of HOD/Dean-Academics/Dean-Examinations will take the final decision on the conduct of mid-term examination.

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 Mid examination (**the average of the two examinations will be taken into account**) and 70 marks for end semester examination.**

V There shall be an **industry-oriented mini-Project**, in collaboration with an industry of their specialization, to be taken up during the summer vacation after III year II Semester examination. The **industry oriented mini project shall be evaluated during the IV year I Semester.** The industry oriented mini project shall be submitted in report form and should be presented before a committee, which shall be evaluated for **100 marks.** The committee consists of Head of the Department, the supervisor of mini project and a senior faculty member of the department. There shall be **no mid-term assessment for industry oriented mini project. However, attending the shadow engineering program is a pre – requisite for evaluating industry – oriented mini project**. Students should submit a report on learning outcomes of the shadow engineering and Engineer in Mirror. Every student should attend shadow engineering and Engineer in Mirror programme in an industry for not more than a week days during second year and third year respectively.

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 consisting of the Head of the Department, Seminar supervisor and a senior faculty member. **The seminar will be evaluated for 100 marks based on the report and presentation made.**

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 **after submitting M.T.P record in complete**. 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 Midterm assessment for the Comprehensive viva-voce.**

viii. The Project work shall be started by the student in the beginning of the IV year I Semester. Out of a total of **200 marks** for the project work, **60 marks shall be for Midterm Evaluation** and **140 marks for the Semester end Examination**. The viva-voce shall be conducted by a committee comprising of an external examiner, Head of the Department and the project supervisor and one senior faculty. The evaluation of project work shall be conducted at the end of the IV year II Semester. **The Midterm Evaluation shall be on the basis of three Seminars conducted during the IV year II Semester for 30 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.**

3. Semester end Examination

(a) Theory Courses

Each course is evaluated for 70 marks. Examination is of 3 hours duration. Question Paper Pattern is as follows

Part A:- 30 Marks Compulsory

5X1Marks (One question from each unit)

5X2Marks (One question from each unit)

5X3Marks (One question from each unit)

Part B:- 40 Marks (4 out of 6 questions) (At least one question from each unit)

(b) Practical Courses

Each lab course is evaluated for 70 marks. The examination shall be conducted by the laboratory teacher and another senior teacher concerned with the subject of the same/other department/Industry. One of examiner will be appointed by the Controller of Examinations in consultation with HOD as and when required and is evaluated as per standard format.

(c) Supplementary Examinations

Supplementary Examinations will be conducted for the current semester after the declaration of the results of the regular examination of that semester.

4. Attendance Requirements

i. A student shall be eligible to appear for the Semester end examinations if he / she acquire a **minimum of 75% of attendance in aggregate of all the subjects** for 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 not promoted to the next Semester unless he satisfies the attendance requirement of the present Semester, as applicable. He may seek re-admission for that Semester when offered next.

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

v. Students whose shortage of attendance is not condoned / not paid the stipulated fee in any Semester are not eligible to take their end semester examination of that Semester.

5. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item No.**4.**

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 Midterm evaluation and end semester examination taken together.**

ii. A student shall be **promoted from II to III year** only if he fulfills the academic requirement of getting **50 credits from the examinations held upto II Year II Semester including Supplementary examinations of II B.Tech II Semester.**

iii. A student shall be **promoted from III year to IV year** only if he fulfills the academic requirement of getting a total of **75 credits from the examinations held upto III Year II Semester including Supplementary examinations of III B.Tech II Semester.**

Iv. **A** student shall register and put up minimum academic requirement in all 200 credits and earn atleast 192 credits. Marks obtained in these credits shall be considered for the calculation of Cumulative Grade Point Average **(CGPA) and percentage of marks**.

v. The student should obtain two certificate courses during his/her course of study

vi. Students who fail to earn atleast 192 credits as indicated in the course structure **within eight academic years** from the year of their admission shall **forfeit their seat** in B.Tech. Course and their **admission stand Cancelled.**

6. Course pattern

i. The entire course of study is of four academic years. **All I, II, III and IV years are of Semester pattern.**

ii. A student eligible to appear for the end semester examination in a subject, but absent or has failed in the end semester 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 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 may be eligible for promotion to the next year after obtaining required number of credits and fulfillment of the academic requirements.

Award of B.Tech. Degree and Class

A student will be declared eligible for the award of the B. Tech. Degree if he/she fulfils 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 **200 credits** and secured a minimum of **192 credits with compulsory subjects as listed in Table.**

Table: Compulsory Subjects

Serial Number	Subject Particulars
1.	All Practical Subjects
2.	Industry oriented mini project
3.	Comprehensive Viva-Voce
4.	Seminar
5.	Project work

iii) The student should obtain two certificate courses during his/her course of study

NOTE: 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.

7. CGPA System:

Method of awarding absolute grades and grade points:

The **absolute grading method** is followed, based on the total marks obtained in internal and external examinations. Grades and grade points are assigned as per the Table given below

B.Tech Program: The Absolute Grading Method is followed, based on the total marks obtained in internal and external examinations. Grades and Grade points are assigned as given below

Marks Obtained	Grade	Description of Grade	Grade Points(GP) Value Per Credit
>=90	O	Outstanding	10.00
>=80 and <89.99	A+	Excellent	9.00
>=70 and <79.99	A	Very Good	8.00
>=60 and <69.99	B	Good	7.00
>=50 and <59.99	C	Fair	6.00
>=40 and <49.99	D	Pass	5.00
<40	F	Remedial	
Not Appeared the Exam(s)	N	Absent	

The student is eligible for the award of the B.Tech degree with the class as mentioned in the Table.

CGPA	CLASS
>= 7.5	First Class with Distinction
>= 6.5 and <7.5	First class
>= 5.5 and < 6.5	Second Class
>=5.0 and < 5.5	Pass class

$$SGPA = \frac{Total\ Earned\ Weighted\ Grade\ Points\ for\ that\ Semester}{Total\ Credits\ for\ the\ Semester}$$

$$SGPA = \frac{\sum_{i=1}^{P} Ci * Gi}{\sum_{i=1}^{P} Ci}$$

Calculation of Semester Grade Points Average (SGPA):

The performance of each student at the end of the each semester is indicated in terms of SGPA. The SGPA is calculated as below:

Where 'Ci' = Number of Credits allotted to particular subject 'I'

'Gi' = Grade Point corresponding to the letter grade awarded in that subject 'i"

'i"= 1,2,…..P represent the number of subjects for that particular semester

* **SGPA is calculated and awarded for the candidates who pass all the courses in a semester.**

Calculation of Cumulative Grade Point Average (CGPA) for Entire Programme. The CGPA is calculated as below:

Assessment of the overall performance of a student is obtained by calculating Cumulative Grade Point Average (CGPA), which is weighted average of the grade points obtained in all subjects during the course of study.

$$CGPA = \frac{\sum_{i=1}^{m} Ci * Gi}{\sum_{i=1}^{m} Ci}$$

Where Ci= Number of credits allotted to a particular subject 'I"

Gi = Grade Point corresponding to the letter grade awarded in that subject 'i"

I= 1,2,….m represent the number of subjects of the entire program.

Grade lower than D in any subject is not considered for CGPA calculation. The CGPA is awarded only when the student acquires the required number of credits prescribed for the program.

Grade Card

The grade card issued shall contain the following:

a) The credits for each subject offered in that semester

b) The letter grade and grade point awarded in each subject

c) The **SGPA/CGPA**

d) Total number of credits earned by the student up to the end of that semester.

e) Award list indicating the marks awarded to the student.

8. 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. The award or issue of the Degree may also be withheld in such cases.

9. **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 BoS chairman of the respective department. He/She will be admitted under the regulation of the batch in which he/she is readmitted.

10. Minimum Instruction Days

The minimum instruction days for each Semester shall be **90 instruction days.**

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

12. 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 transfer of students from other college or from this institute is to approved by the Governing Council.

13. 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 discrepancy/ambiguity/doubt arises in the above rules and regulations, the decision of the Principal shall be final.

iv. The Chairmen Academic Council 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.

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

(Applicable for students admitted from the academic year 2013-2014)

(i) Registered for 150 credits and secured a minimum of 142 credits with compulsory subjects as listed in table.

Table: Compulsory Subjects

Serial Number	Subject Particulars
1.	All Practical Subjects
2.	Industry oriented mini project
3.	Comprehensive Viva-Voce
4.	Seminar
5.	Project work

(ii) A student who fails to earn a minimum of 142 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) A student shall be promoted from Third year to Fourth year only on fulfilling the academic requirements of securing 50 credits from the examinations held upto III B.Tech II Semester including Supplementary Examinations.

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

15. Malpractice Rules

Disciplinary Action for Malpractices/Improper Conduct in Examinations

	Nature of Malpractices/Improper conduct	**Punishment**
	If the candidate:	
1.	(a) Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
	(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.
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 end semester 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 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 end semester 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/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk	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

	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.	appear for the remaining examinations of the subjects of that semester/year. The candidates are also 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 end semester examinations including supplementary 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.	If the student belongs to the college, 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.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the academic council of the Institute for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

Punishments to the candidates as per the above guidelines.

Malpractice identified at Spot center during valuation

The following procedure is to be followed in the case of malpractice cases detected during valuation, scrutiny etc. at spot center.

1) Malpractice is detected at the spot valuation. The case is to be referred to the malpractice committee. Malpractice committee will meet and discuss/question the candidate and based on the evidences, the committee will recommend suitable action on the candidate.
2) A notice is to be served to the candidate(s) involved through the Principal to his address and to the candidate(s) permanent address regarding the malpractice and seek explanations.
3) The involvement of staff who are in charge of conducting examinations, invigilators valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing in correct or misleading information) that infringe upon the course of natural justice to one and all concerned at the examinations shall be viewed seriously and recommended for award of appropriate punishment after thorough enquire.
4) Based on the explanation and recommendation of the committee action may be initiated.
5) **Malpractice committee:**

i.	Principal	Chairman
ii.	Controller of Examinations	Convener
iii.	Invigilator	Member
iv.	Chief Examiner of the subject/subject expert	Member
v.	Concerned Heads of the Department	Member

B.TECH. (MECHANICAL ENGINEERING):

Degree:	**B.Tech.**	Specialization:	**Mechanical Engineering**
Duration:	**4 Years**	Details:	**8 semesters**
Mode of	**Full-time**	Year of starting:	**1995**
Intake:	**120**	Regulations:	**R13**

- **Overview of the programme:**

  Mechanical engineering is a broad and diverse discipline that derives its breadth from the need to design, analyze and manufacture everything from small to large components, assemblies., and systems either stationary or in motion. The four year programme is designed to prepare graduates with creative thinking that allows them to design a product, use the analytical tools to achieve the design goals, ability to overcome constraints, work in a team to find solutions with social relevance. The programme has been running for the last 18 years and is regularly updated in line with the subject developments and changing industrial practices. Mechanical engineers learn about materials, solid and fluid mechanics, thermodynamics, heat transfer, control, instrumentation, design, and manufacturing processes, etc., to understand mechanical systems. Specialized mechanical engineering subjects include unconventional machining processes, composite materials, MEMS, nanotechnology, tribology, vibrations etc.

- **Objectives:**
  - To prepare students for successful careers as mechanical engineers in organizations that meet the needs of Indian and global/multinational industrial/research establishments.
  - To provide a strong foundation in mathematical, scientific and engineering fundamentals in both domain and cross domain spheres, that enables students to visualize, analyze and solve mechanical engineering problems and be innovative and research oriented.
  - To train students with a wide spectrum of scientific and engineering courses so that students could comprehend, analyze, design and create products and services that address real life problems, which are efficient and cost effective.
  - To inculcate in students a professional and ethical attitude, impart effective communication skills and ability to work in teams with multidisciplinary approach, be part of and interact with professional bodies so as to resolve engineering issues of social relevance.
  - To provide students with an academic environment that fosters excellence, leadership, yearning to pursue higher studies and passion for lifelong learning so as to have a successful professional career.

- **Outcomes:**
  - **Engineering Knowledge:** Graduates will demonstrate basic knowledge of mathematics, sciences and mechanical engineering and essential computational techniques/procedures that aid in problem solving and be in a position to face competitive examinations.
  - **Problem Analysis:** Graduates will demonstrate ability to identify, critically analyze, formulate and solve mechanical engineering problems.
  - **Design and Development solutions:** Graduates will demonstrate ability to design a system, a component or a process in the domain of mechanical engineering, prepare a model, conduct experiments, analyze and interpret data.
  - **Conduct Investigations of Complex Problems:** Graduates will demonstrate an ability to visualize and work in engineering and science laboratories on multidisciplinary tasks as teams, conduct investigations and solve complex problems.
  - **Modern tool usage:** Graduates will demonstrate skills to use modern engineering tools, equipments, processes, state of the- art software packages on modeling and analysis for solving problems.
  - **The engineer and society:** Graduates will demonstrate understanding of impact of engineering solutions on the society to ensure that no ill effects befall and be aware of contemporary issues.
  - **Environment and sustainability:** Graduates will demonstrate the understanding of impact of engineering solutions on the environment to mitigate any ill effects and ensure sustainability of solutions arrived.
  - **Ethics:** Graduates will demonstrate knowledge, understanding and application of professional and ethical responsibilities and human values in all professional transactions.
  - **Individual and Team Work:** Graduates will demonstrate ability to work as an individual as well as a team member on engineering problems and be able to understand group dynamics and play his role appropriately in the group and develope entrepreneurial skills.
  - **Communication:** Graduates will demonstrate ability to communicate effectively in both verbal and written form.
  - **Project Management and Finance:** Graduates will demonstrate ability to administer and regulate projects with emphases on time management, financial management and personnel management.
  - **Life Long Learning:** Graduates will demonstrate penchant for self education, inclination for updating with developments, participate in professional societies, interact with stalwarts in the field and continue life-long learning.

- **Opportunities:**

  The passed out students of this programmes are well received by the core manufacturing industry as well as software organizations. The students discharge responsibilities as design engineers, manufacturing engineers, production engineers, engineering managers, systems engineers, or R & D engineers. They are placed in various companies like Tata Consultancy Services, Hyundai, Honda, Mahindra & Mahindra, Denison Hydraulics - Veljan, info tech, cap Gemini, Rane Valves to name a few. Some of the graduate students have opted for pursuing higher studies in various advanced topics of mechanical engineering, both in India and in universities abroad – US, Germany, Canada etc.

VNR Vignana Jyothi Institute of Engineering & Technology
B. TECH (ME)

I YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
13MTH001	Advanced Calculus	3	1	3
13PHY001	Engineering Physics	3	1	3
13CHE002	Chemistry of Engineering Materials	3	0	3
13CSE078	C and Data Structures	4	1	4
13MED001	Engineering Mechanics – I	4	1	4
13MED101	Engineering Graphics – I	0	6	3
13EPC101	Engg. Physics and Chemistry Lab	0	3	2
13CSE125	C and Data Structures Laboratory	0	3	2
Total		**17**	**16**	**24**

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

VNR Vignana Jyothi Institute of Engineering & Technology
B. TECH (ME)

I YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
13CED004	Environmental Studies	3	0	3
13MTH002	Linear Algebra and Ordinary Differential Equations	3	1	3
13PHY002	Physics of Materials	3	0	3
13CHE001	Engineering Chemistry	3	0	3
13ENG001	English	3	0	3
13MED002	Engineering Mechanics – II	4	1	4
13MED102	Engineering Graphics - II (using AutoCAD)	0	6	3
13MED103	IT and Engineering Workshop	0	3	2
13ENG101	English Language Communication Skills Lab	0	3	2
Total		**19**	**14**	**26**

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

VNR Vignana Jyothi Institute of Engineering and Technology
B. TECH (ME)

II YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
13MTH005	Partial Differential Equations with applications and Complex Analysis	3	1	3
13MED003	Mechanics of Solids	4	1	4
13MED004	Thermodynamics	4	1	4
13MED005	Metallurgy and Material Science	4	0	4
13MED006	Fluid Mechanics and Hydraulic Machines	4	1	4
13MED104	Metallurgy and Material Science Lab	0	3	2
13MED105	Mechanics of Solids Lab	0	3	2
13MED106	Fluid Mechanics and Hydraulic Machines Lab	0	3	2
Total		**19**	**13**	**25**

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

VNR Vignana Jyothi Institute of Engineering & Technology
B. TECH (ME)

II YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
13MTH003	Numerical Analysis and Linear Programming	3	1	3
13CMS001	Business Economics and Financial Analysis	4	0	4
13MED007	Kinematics of Machinery	4	0	4
13MED008	Thermal Engineering	4	0	4
13EEE079	Basic Electrical and Electronics Engineering	3	1	3
13MED107	Machine Drawing	0	6	3
13MED108	Thermal Engineering Lab	0	3	2
13EEE179	Basic Electrical and Electronics Engineering Lab	0	3	2
Total		**18**	**14**	**25**

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

VNR Vignana Jyothi Institute of Engineering and Technology
B. TECH (ME)

III YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
13MED009	Production Technology	3	0	3
13MED010	Dynamics of Machinery	4	1	4
13MED011	Mechanical Engineering Design - I	4	1	4
13MED012	Heat and Mass Transfer	4	1	4
13MED013	Turbo Machinery	3	1	3
13MED014	Operations Research	3	1	3
13MED109	Production Technology Lab	0	3	2
13MED110	Heat and Mass Transfer Lab	0	3	2
Total		**21**	**11**	**25**

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

VNR Vignana Jyothi Institute of Engineering & Technology
B. TECH (ME)

III YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
13MED015	Machine Tools	4	1	4
13MED016	Mechanical Engineering Design - II	4	1	4
13MED017	Metrology and Quality Control	4	0	4
13EIE080	Instrumentation and Control Systems	4	0	4
13CED037	**Elective – I OPEN** Disaster Management	3	1	3
13ITD005	JAVA Programming			
13AED010	Modern Automobile Technologies			
13MED020	Non Conventional Energy Source			
13CSE016	Intellectual Property Rights			
13MED111	Machine Tools and Metrology Lab	0	3	2
13ENG102	Advanced English Communication Skills Laboratory	0	3	2
13EIE176	Instrumentation and Control Systems Lab	0	3	2
Total		**19**	**12**	**25**

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

VNR Vignana Jyothi Institute of Engineering and Technology
B. TECH (ME)

IV YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
13MED018	Finite Element Method	3	1	3
13MED019	CAD/CAM	4	0	4
13AED076	Automobile Engineering	3	1	3
13MED021	**Elective – II** Automation & Robotics	3	1	3
13MED022	Composite Materials			
13MED023	Theory of Metal Cutting			
13MED025	Surface Modification Techniques			
13MED026	Tool Design			
13MED027	**Elective – III** Mechanical Vibrations	3	1	3
13MTH006	Probability & Stochastic Process			
13MED028	Advanced Solid Mechanics			
13MED030	Refrigeration and Air Conditioning			
13MED031	Introduction to Aircraft Industry and Aircraft Systems			
13MED112	CAD/CAM Lab	0	3	2
13MED113	Production Drawing Practice Lab	0	3	2
13MED114	Automation & Robotics Lab	0	3	2
13MED204	Comprehensive Viva Voce	0	0	2
13MED201	Industrial Oriented - Mini Project	0	4	2
Total		**16**	**17**	**26**

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

VNR Vignana Jyothi Institute of Engineering and Technology
B. TECH (ME)

IV YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
13MED032	Industrial Engineering and Management	4	0	4
13MED033	**Elective – IV** Unconventional Machining processes	3	1	3
13MED034	Nano Science and Technology			
13MED036	Design for Manufacturing			
13MED037	Principles of Entrepreneurship			
13CSE077	Interactive Computer Graphics			
13MED038	**Elective – V** Product Life Cycle Management	3	1	3
13MED039	Plant Layout and Material Handling Systems			
13MED040	Computational Fluid Dynamics			
13MED042	Metal Casting Technology			
13MED043	Design of Aircraft Structures			
13MED044	Power Plant Engineering			
13MED203	Technical Seminar	0	3	2
13MED202	Project Work	0	18	12
Total		**10**	**23**	**24**

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

VNR Vignana Jyothi Institute of Engineering & Technology

I Year I Sem, B.Tech– Common to all branches	**L**	**T/P/D**	**C**
	3	**1**	**3**

(13MTH001) ADVANCED CALCULUS

Course prerequisites: Differentiation, Integration

Course Objectives:

- Understand Taylor's theorem and its application to maxima and minima of f(x,y).
- Understand the process of curve sketching.
- Understand multiple integrals and its applications.
- Apply the integral theorems of vector calculus.

Course Outcomes:

Students will be able to:

- Solve problems involving the maxima and minima of f(x,y).
- Apply the curve tracing concepts to find arc length of curves, surface area, volume of solids of revolution.
- Evaluate the multiple integrals using appropriate change of variables.
- Verify the integral theorems.

UNIT I

CALCULUS OF ONE AND SEVERAL REAL VARIABLES

Mean value thoerems **–** Rolle's Thoerem, Lagrange's Mean value thoerem Cauchy's Mean value theorem**,** Taylor's expansion and McLaurin's expansion of functions (without proofs).

Partial differentiation, partial derivatives of first and second order in terms of partial derivaties, Jacobian, Euler's theorem on homogeneous functions, change of variables, Taylor's theorem of two variables(without proof) and its application. Maxima and Minima of two variables, Langrange's method of undeterrmined multipliers.

UNIT II

CURVE TRACING AND RELATED APPLICATIONS

Curvature of curves in Cartesian, parametric and polar coordinates. Tracing of curves in Cartesian, parametric and polar coordinates (like conics, astroid, hypocycloid, Folium of Descartes, Cycloid, Circle, Cardiode, Lemniscate). Applications - finding area under the curves, Length of the curves, volume and surface area of solids of revolution

UNIT III

MULTIPLE INTEGRALS

Introduction of Multiple integrals, evaluation of double and triple integrals, change of order of integration change of variables, Cylindrical and Spherical polar coordinates.

Application to evaluation of plane areas, volumes and surface areas of solids of revolution.

UNIT IV

VECTOR DIFFERENTIAL CALCULUS

Scalar and Vector point functions, Gradient, Divergence, Curl with geometrical & physical interpretation, Directional derivatives, Properties.

UNIT V

VECTOR INTEGRAL CALCULUS

Line integrals and application to Work done and Circulation, Scalar potential function, Surface integrals and Volume integrals, Gauss divergence theorem, Green's theorem , Stokes' theorem (theorems without proof).

TEXT BOOKS:

1. Higher Engineering Mathematics – by B. S. Grewal, Khanna publishers
2. Calculus and Analytic Geometry by Thomas and Finney, 9th edition; Publisher: Pearson Education.

REFERENCES :

1. Elementary Analysis: The Theory of Calculus by Kenneth Ross; Publisher: Springer
2. Advanced Engineering Mathematics by Erwin Kreyszig, 8th edition; Publisher: John Wiley.
3. Advanced Engineering Mathematics by Peter 'O' Neil, publisher: Cengage Learning .
4. Advanced Engineering Mathematics by R.K.Jain and S.R.K.Iyengar; Narosa Publications

VNR Vignana Jyothi Institute of Engineering & Technology

I Year I Sem, B.Tech– Common to all branches	**L**	**T/P/D**	**C**
	3	**1**	**3**

(13PHY001) ENGINEERING PHYSICS

Course Objectives:

- To supplement and enhance the basic concepts in Physics essentially required in the study of materials as well as interaction of light with matter, interaction of light with matter through physical phenomena like interference, diffraction and polarization.
- To know and understand some important applications of lasers and optical fibers.
- To learn the importance of wave and particle nature of light and to understand the behavior of an electron in one dimensional potential box.
- To understand the effect of temperature on Fermi Dirac Distribution Function and also learn the behavior of an electron in a periodic potential, the new concept of Effective mass of an electron and to know the classification of materials into conductors, semiconductors and insulators.

Course Outcomes:

Students will be able to:

- Understand the Phenomenon of Interference, Diffraction& Polarization.
- Learn the principle, working, construction and energy mechanism of various lasers and their applications explain the light signal propagation and attenuation through optical fiber.
- Understand the differences between particle and wave nature, energy states in one dimensional potential box and also the Consequences of Heisenberg's Uncertainty principle.
- Understand the one dimensional Schrodinger's wave equation and the effect of temperature on Fermi-Dirac Distribution, Kronig Penny model.

UNIT – I

INTERFERENCE:

Superposition principle, resultant amplitude, coherence, methods to obtain coherent sources, interference, Young's double slit experiment, interference in thin films by reflection, Newton's rings Experiment.

DIFFRACTION-I:

Distinguish between Fraunhofer and Fresnel diffraction, diffraction at single slit (Qualitative and Quantitative (Phasors approach)).

UNIT - II

DIFFRACTION-II

Diffraction at double slit, circular aperture, and multiple slits (grating)(Qualitative Approach), Resolution of spectral lines, Rayleigh criterion, and resolving power of grating.

POLARIZATION

Polarization phenomenon, Brewster's Law and Malus law, examples, types of polarization, double refraction, Nicol prism, Quarter and Half wave plates.

UNIT – III

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 –Semiconductor Laser – Applications of lasers.

FIBER OPTICS:

Principle of optical fiber and properties – Acceptance angle and acceptance cone – Numerical aperture –Types of fibers and refractive index profiles – Qualitative analysis of attenuation in optical fibers –Application of optical fibers.

UNIT - IV

ELEMENTS OF STATISTICAL MECHANICS:

Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics (non-mathematical treatment); Photon gas, Planck's law of black body radiation; Deduction of Wien's law and Rayleigh-Jeans law from Plank's law.

PRINCIPLES OF QUANTUM MECHANICS:

Waves and particles – De Broglie hypothesis - Matter waves - Davisson and Germer experiment –Heisenberg's uncertainty principle - Schrodinger Wave Equation – Wave function and its Physical Significance - Particle in one dimensional potential box(wave functions, probability densities and energy states).

UNIT - V

FREE ELECTRON FERMI GAS:

Energy levels in one dimension, Effect of temperature on the Fermi-Dirac distribution, Free electron gas in three dimensions, electrical conductivity & Ohm's law, Electrical Resistivity of Metals (Qualitative).

BAND THEORY OF SOLIDS:

Electron in a periodic potential; Bloch Theorem; Kronig-Penney model (non-mathematical treatment); Origin of energy band formation in solids; Classification of materials into conductors, semiconductors & Insulators; and Concept of effective mass of an electron.

TEXT BOOKS:

1. Physics vol.2, by Halliday, Resnick and Krane; John Wiley & Sons.
2. Concepts of Modern physics by Arthur Beiser, McGraw Hill Inc.
3. Introduction to Solid State Physics by Charles Kittel : John Wiley & Sons.

REFERENCE BOOKS:

1. Engineering Physics by R.K.Gaur and S.L.Gupta; Dhanpat Rai and Sons.
2. Applied Physics by P.K.Mittal, IK International Publishing House (P) Ltd.
3. Optics by Ghatak and Thyagarajan, Tata Mc Graw.
4. Engineering Physics by G Sahashra Buddhe; University Press.
5. Elements of Solid State Physics by J.P.Srivatsva, PHI Publishers.
6. Introduction to Optical Communication by G. Keiser.
7. Quantum Mechanics by Gupta Kumar Sharma.

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I Year B.Tech CE, ME & AE – I Sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(13CHE002) CHEMISTRY OF ENGINEERING MATERIALS

Course Prerequisites: **General chemistry**

Course Objectives:

- A sustainable energy supply, is needed for promoting economic development as well as protecting the environment.
- Understanding the significance of various Engineering materials like cement abrasives, adhesives and composites in structural enhancement of materials.
- Exposure to refractories and ceramics in industries and most recently, aerospace technology.
- Familiarize lubricants as a basic and fundamental necessity for the maintenance of any machines.

Course outcomes:

Students will be able to:

- Acquire knowledge of the types of fuels, their sources and purification techniques.
- Understand the manufacturing process of cement, its properties and usage of abrasives, adhesives and composites in various industrial processes.
- Benefits of refractories as heat-resistant materials and applications of ceramics in various fields.
- Knowledge of lubricants in regard to their applications in various machines.

UNIT I

Energy sources

Fuels - classification (solid, liquid, gaseous), calorific value of fuel (HCV, LCV), determination of calorific value by bomb calorimeter; Solid fuels – coal – analysis – proximate and ultimate analysis and their significance; Liquid fuels – petroleum, refining of petroleum, cracking, knocking, synthetic petrol – Bergius and Fischer-Tropsch's process. Biofuels- characteristics, biodiesel (preparation, properties and applications); Gaseous fuels – natural gas, LPG, CNG (composition and uses), Combustion – problems.

UNIT II

Cement

Types of cement**;** Chemical constituents and composition of Portland cement; Manufacturing methods of Portland cement (wet and dry processes); Properties of cement - Setting & Hardening of cement (reactions); Decay of cement; Cement concrete - RCC.

UNIT III

Engineering materials

III a) Abrasives & Adhesives - Introduction, classification of abrasives, and their applications. Criteria of a good adhesive, classification and their applications.

III b) Composites: Need for composites, classification and their applications.

UNIT IV

Refractories and Ceramics

Refractories: Definition; Classification with examples; Characteristics of a good refractory; Causes for the failure of a refractory material; Properties of refractories - refractoriness, RUL test, porosity.

Ceramics: Introduction; Classification, Glazing and Applications of glazed & non glazed ceramics.

UNIT V

Lubricants

Criteria of a good lubricant; Classification of lubricants-lubricating oils; Greases or semisolid lubricants; Solid lubricants; Mechanism of lubrication-fluid film lubrication, boundary lubrication, and extreme pressure lubrication; Biodegradable lubricants: types of biodegradable lubricants, advantages and disadvantages of biodegradable lubricants. Properties of lubricants - viscosity, cloud point, pour point, flash & fire point, mechanical stability, oiliness, and carbon residue.

TEXT BOOKS:

1. Text book of Engineering Chemistry by Y.Bharathi Kumari, and Jyotsna Cherukuri; Publisher: VGS Book Links.
2. Engineering Chemistry by P.C.Jain & Monica Jain; Publisher: Dhanpatrai.
3. Text book of Engineering Chemistry by S.S. Dhara & Mukkanti; Publisher: S.Chand & Co.

REFERENCES:

1. Engineering Chemistry by O G Palanna
2. Text book of Engineering Chemistry by Balram Pani; Publisher: Galgotia Publications Pvt.Ltd.
3. Text book of Engineering Chemistry by Shashi Chawla Publisher: Dhanpat rai &Co
4. Engineering Chemistry by R.P.Mani, S.N. Mishra, B.Rama Devi, Cengage Learning Publications.
5. Text book of Engineering Chemistry by R.Gopalan, D.Venkappayya, Sulochana Nagarajan; Publisher: Vikas Publishers.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

I Year B. Tech ME & AE - I Sem	**L**	**T/P/D**	**C**
	4	**1**	**4**

(13CSE078) C AND DATA STRUCTURES

Course Objectives:

- Gain a working knowledge of C and data structure programming.
- Learn how to write modular, efficient and readable C and data structure programs.
- Utilize pointers to efficiently solve problems.
- Explore searching and sorting concepts to solve problem.

Course Outcomes:

- Understand the basic terminology used in computer programming.
- Write, compile and debug programs in C language.
- Analyze programs involving decision structures, loops and functions.
- Design programs using searching and sorting techniques.

UNIT – I

INTRODUCTION TO COMPUTERS

Computer Systems, Computing Environments, Computer languages, creating and running programs, Software Development Methods.

UNIT – II

Algorithm / pseudo code, flowchart, program development steps, structure of C program, identifiers, basic data types, Constants, variables, operators, expressions, precedence and order of evaluation.

Input-output statements, if and switch statements, loops- while, do-while and for statements, break, continue, goto and labels, example C programs.

UNIT - III

FUNCTIONS

Basic concepts, parameter passing, storage classes, scope rules, user defined functions, standard library functions, recursive functions, example C programs.

ARRAYS

Basic concepts, one-dimensional and two-dimensional arrays, Character array, string handling functions, example C programs.

UNIT - IV

DERIVED TYPES- STRUCTURES:

Basic concepts, nested structures, arrays of structures, program examples.

POINTERS:

Basic concepts, pointers and functions, pointers and strings, pointers and arrays, pointers and structures, self referential structures, example C programs.

UNIT - V

SEARCHING:

Linear and binary search methods, sorting - Bubble sort, selection sort, Insertion sort.

INTRODUCTION TO DATA STRUCTURES

Dynamic memory allocation, Linked Lists, stacks, queues - implementation using arrays and Linked Lists.

TEXT BOOKS:

1. Computer science, A structured programming approach using C, B.A. Forouzan and R.F. Gilberg, Third edition, Thomson.
2. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education.
3. C Programming andData structures, E.Balagurusamy,TMH.

REFERENCES:

1. Data Structures Using C - A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education.
2. Programming in C - Stephen G. Kochan, III Edition, Pearson Eductaion.
3. Data Structures and Program Design in C, R.Kruse, C.L. Tondo, BP Leung, Shashi M, Second Edition, Pearson Education.

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I Year B. Tech ME / AE I Sem	**L**	**T/P/D**	**C**
	4	**1**	**4**

(13MED001) ENGINEERING MECHANICS – I

Course Prerequisites: Physics, Mathematics

Course Objectives:

- Understand particle, body, rigid body, concept of force, analysis of forces acting on a rigid body.
- Understand moment and the principle of moments.
- Understand friction and its implications.

Course Outcomes: Students will be able to:

- Draw the free body diagram of a body acted upon by a system of forces.
- Analyse the forces acting on a body and write the equations of equilibrium.
- Write the moment equations of equilibrium.

UNIT – I

FORCES:

Introduction to Engineering Mechanics – Basic Concepts: Rigid body, Force, specifications of a force, Classification of a force system, Composition of force, Resolution of forces, Rectangular components, parallelogram of forces, Triangle of forces, Polygon law of forces, Equilibrium of Collinear forces, Equilibrium law, Superposition and Transmissibility, Law of action and reaction, Free Body Diagram, Active and reactive forces, Types of supports, Lami's theorem, Resultant, Equilibrant, Method of projections, Equations of equilibrium, Resultant of coplanar concurrent forces, Equilibrium of coplanar concurrent forces.

UNIT – II

MOMENTS:

Moment, Moment of a force, Moment of a force about a point, Moment of a force about an axis, Arm of the force, Varignon's principle, Parallel forces, Resultant of parallel forces, Couple, Moment of a couple about any point lying in the plane, Resolution of a force into a force-couple and vice versa, Resultant of coplanar non-concurrent forces, Equilibrium of coplanar non-concurrent forces.

UNIT – III

FRICTION:

Types of Friction, Limiting Friction, Coulomb Laws of Friction, Coefficient of friction Static friction, Kinetic friction, Angle of friction, Cone of static friction, Equilibrium of bodies on rough horizontal and inclined planes, Equilibrium of connected bodies on rough horizontal and inclined planes, Ladder friction, wedge friction, screw friction.

UNIT – IV

CENTROID, CENTRE OF GRAVITY:

Centroid, Centroids of simple figures (from basic principles) – Centroids of composite figures and built-up sections, Centroids of Symmetric figures, Center of parallel forces, Center of gravity, Centre of gravity of simple bodies (from basic principles), Centre of gravity of composite bodies, Centre of gravity of Symmetric bodies, Pappus theorems.

UNIT – V

MOMENT OF INERTIA:

Introduction, Moment of inertia of plane areas, Radius of gyration, Polar moment of inertia, Parallel axis theorem, Perpendicular axis theorem, Moments of inertia of simple figures from basic principles and composite figures. Product of inertia, moment of inertia about inclined axis, Principle moment of inertia. Mass moment of Inertia: Introduction, Moments of inertia of simple bodies from basic principles and composite bodies.

TEXT BOOKS:

1. Engineering Mechanics by Timoshenko and Young, Tata Mc-Graw Hill Publishers.
2. Engineering Mechanics by RC Hibbeler,pearson publishers.
3. Engineering Mechanics by S.S. Bhavikatti, New age International Publishers.

REFERENCES:

1. Singer's Engineering Mechanics by K. Vijaya Kumar Reddy ,BS Publishers.
2. Engineering Mechanics (Statics) by Meriam and Kraige, John Wiley Publishers.
3. Engineering Mechanics by Tayal, Umesh Publishers.

VNR Vignana Jyothi Institute of Engineering and Technology

I Year B.Tech ME / AE I Sem	**L**	**T/P/D**	**C**
	0	**6**	**3**

(13MED101) ENGINEERING GRAPHICS-1

Course Prerequisites: Geometrical construction

Course Objectives:

- Understand the usage of drawing instruments.
- Understand the construction methods for drawing conic sections.
- Identify the significance of curves in engineering practice like bridges, building, arches etc.
- Understand first and third angle projections and methods.

Course Outcomes:

Students will be able to:

- Visualize the objects looking into projections.
- Convert projections for isometric to orthographic and vice versa.
- Work with Auto CAD for the above

UNIT I

Introduction to **AutoCAD**.

INTRODUCTION TO ENGINEERING DRAWING

Principles of engineering graphics and their significance; Drawing instruments and their uses; Conventions in drawing-lettering; BIS Convention; Different types of scales; Scale of chords.

UNIT II

CURVES USED IN ENGINEERING PRACTICE AND THEIR CONSTRUCTION

Ellipse; Parabola; Hyperbola and Rectangular hyperbola; Cycloid; Epicycloids; Hypocycloid – Involutes.

UNIT III

PROJECTION OF POINTS AND LINES

Points and straight lines inclined to both planes; True lengths and traces.

UNIT IV

PROJECTION OF PLANES

Projection of regular planes inclined to both planes; Auxiliary projections.

UNIT V

PROJECTION OF SOLIDS

Projection of regular solids-inclined to both planes; Auxiliary projections.

TEXT BOOKS:

1. Elementary Engineering Drawing by N.D. Bhatt; Publisher: Charotar Publishing House.
2. Engineering Drawing by K.L. Narayana and P. Kannaiah; Publisher: Scitech Publications.
3. Engineering Graphics for degree by K.C. John; Publisher: Prentice Hall of India.

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I Year B. Tech ME / AE I Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13EPC101)ENGINEERING PHYSICS AND CHEMISTRY LAB

ENGINEERING PHYSICS LAB

Course Objectives:

- To practically learn interaction of light with matter through physical phenomena like interference, diffraction and dispersion.
- To expose to the principle of superposition and resonance.
- To demonstrate the formation of standing waves and to understand the mechanical wave behavior and to determine Rigidity Modulus of different materials of wires.
- To demonstrate basic discharge phenomenon in capacitors and to know the characteristics of the circuit elements, like resistors, capacitors and inductors.

Course Outcomes:

Students will be able to:

- Understand clearly the interference principle in wave theory of light and able to relate it to the formation of Newton Rings and Obtain a pure spectrum when light passes through prism
- Understand the formation and propagation of mechanical waves
- Study simple oscillations of a load attached to a string and relate it to nature of material of string
- Understand the physical significance of time constant and related uses

Any Eight Experiments from the following:

1. Dispersive Power of the material of a Prism using Spectrometer
2. Diffraction Grating (both with Laser and non laser source)
3. Single Slit with laser light
4. Newton's Rings
5. Finding thickness of a thin wire or sheet by forming a wedge shaped film
6. Energy gap of a semiconductor material
7. To determine the rigidity modulus of material of a wire
8. Melde's experiment
9. Sonometer Experiment
10. AC frequency by sonometer method
11. Numerical Aperture and Acceptance angle of an optical fiber cable
12. Attenuation and Bending losses in optical fiber
13. Stewart Gee's experiment
14. Characteristics of LED/Laser Diode.
15. Photo cell/ Solar Cell

16. RC circuit

Book: Essential Practical Lab Manual in Physics: by P.Raghavendra Rao

ENGINEERING CHEMISTRY LAB

Course Prerequisites: General Maths, General chemistry.

Course Objectives:

- Estimation of hardness of water is essential for drinking water and in industries to avoid boiler troubles.
- Knowledge of instrumentation in Colorimeter, Redwood viscometer, Conductivity meter and pH meter.
- Knowledge of preparation of soap.

Course Outcomes: Students will be able to

- Understand the extent of hardness range present in a water sample and its consequences if used for various industrial operations.
- Determination of strength of solutions, pH of various solutions, lubricants usage in machinery to prevent wear and tear.
- Understanding the composition of soap used for washings.

1. **TITRIMETRY**
   Estimation of hardness of water by EDTA method.
2. **INSTRUMENTAL METHODS**
   (i) Conductometry
   Conductometric titration of strong acid Vs Strong base
   (ii) Colorimetry
   Estimation of copper by colorimetric method
   (iii) p^H Metry
   Titration of strong acid Vs Strong base by pH Metry
3. **PHYSICAL PROPERTIES**
   Determination of viscosity of sample oil by Redwood viscometer.
4. **PREPARATIONS**
   Preparation of i) soap ii) Nano-particles

TEXT BOOKS:

1. Laboratory Manual on Engineering Chemistry by S.K.Bhasin and Sudha Rani, Dhanpat Rai Publishing Company.
2. Laboratory Manual on Engineering Chemistry by Y.Bharathi Kumari, Jyotsna Cherukuri, VGS Book Links, Vijayawada

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I Year B. Tech ME & AE I Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13CSE125) C AND DATA STRUCTURES LABORATORY

Course Objectives:

- Gain a working knowledge of C data structure programming
- Learn how to write modular, efficient and readable C and data structure programs
- Utilize pointers to efficiently solve problems
- Utilize searching and sorting concepts to solve problem

Course Outcomes:

- Use different data types in a computer program.
- Design programs involving decision structures, loops and functions, structures and pointers.
- Design programs using searching and sorting techniques.
- Understand stacks, Queues implementation using linked lists.

Week 1

1. Write a program that reads three different integers from the keyboard and prints – sum, average, product, smallest, largest of the numbers.
2. Write a program that reads two integers and prints – difference, quotient and remainder.
3. WAP that reads two integers and determines whether the first is a multiple of the other.

Week 2

1. Write a C program to find the sum of individual digits of a positive integer.
2. Write a C program for Fibonacci sequence.
3. Write a C program to generate the first n terms of the sequence.
4. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Week 3

1. Write a C program to calculate the following Sum:
   Sum=1-x2/2! +x4/4!-x6/6!+x8/8!-x10/10!
2. Write a C program toe find the roots of a quadratic equation.

Week 4

1. Write C programs that use both recursive and non-recursive functions
   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 5

1. Write a C program, which takes two integer operands and one operator from the user,
   Performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)
2. Write a program to print a given number [0-1000] in words. For example, 123 as One Hundred and Twenty Three

Week 6

1. WAP to check whether a given number is an Armstrong, Palindrome, Perfect, Prime, or a Fibonacci Number
2. Write a C program to find both the largest and smallest number in a list of integers

Week 7

1. Write a C program to generate Pascal's triangle.
2. Write a C program to construct a pyramid of numbers.

Week 8

1. Write a C program to calculate
   i) Minimum and maximum of an 1-d array
   ii) Sorting an array
   iii) Searching an array

Week 9

1. Write a C program that uses functions to perform the following:
   i) Addition of Two Matrices
   ii) Multiplication of Two Matrices
   iii) To find the determinant of a 3 by 3 matrix

Week 10

1. Write a C program that uses functions to perform the following operations using Pointers:
   i) To insert a sub-string in to a given main string from a given position.
   ii) To delete n Characters from a given position in a given string.
   iii) To reverse a given string

Week 11

1. Write C Programs to implement Structures and Nested structures with suitable Examples
   (Students has to practice with relevant examples taught in the class room)

Week 12

1. Write C Programs using Pointers and Pointer Arithmetic operations
2. Write C Programs using Pointers to structures, Pointers to Arrays and Pointers to strings
   (Students has to practice with relevant examples taught in the class room)

Week 13

1. Write C Programs to implement the following sorting algorithms
   a. Bubble Sort **b.** Selection sort **c.** Insertion Sort

Week 14

1. Write a C program to implement STACK and QUEUE operations using Arrays.
2. Write a C program to implement STACK and QUEUE operations using Linked Lists

Week 15

1. Write a C programs to implement the following searching techniques.
   a. Linear Search **b.** Binary Search

Week 16

Lab Internal Examination

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

I Year B. Tech ME / AE II Sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(13CED004) ENVIRONMENTAL STUDIES

Course Objectives:

- Develop an understanding of the necessity of protection of environment.
- Develop an understanding of Natural resources.
- Develop an understanding of Biodiversity.
- Develop an understanding of Global Environmental problems.
- Develop an understanding of Environmental pollution.

Course Outcomes:

Students will be able to:

- Acquire the knowledge on environment.
- Acquire the knowledge of various Natural Resources.
- Develop skills in understanding of various environmental problems.
- Develop skills to protect the Environment.

UNIT-I

Environmental Studies:

Introduction, Definition, scope and importance, Ecosystems: Introduction, types, characteristic features, structure and functions of ecosystems. Bio geo chemical cycle, Classification of Eco system.

UNIT-II

Natural Resources :classification of Resources, Land resources, Land as resource, Common property resources, Land degradation, Soil erosion and desertification, Effects of modern agriculture, fertilizer –pesticide problems, Forest resources, Use and over-exploitation.

Mining and dams – their effects on forest and tribal people, Water resources, Use and over- utilization of surface and groundwater, Floods, droughts, Water logging and salinity, Dams –benefits and costs, Conflicts over Water, Energy resources.

UNIT-III

Bio-diversity and its conservation, Value of bio-diversity - consumptive and productive use, social, ethical, aesthetic and option values, Bio-geographical classification of India – India as a mega diversity habitat, Threats to bio-diversity –Hot-spots, habitat loss, poaching of wild life, loss of species, seeds, etc. Conservation of bio-diversity – Insitu and Ex-situ conservation.

UNIT-IV

Environmental Pollution –Local and Global Issues, Nature of thermal pollution and nuclear hazards, Global warming, Acid rain, Ozone depletion., Environmental case studies.

UNIT-V

Environmental Problems in India, Drinking water, sanitation and public health, Effects of the activities on the quality of environment, Water scarcity and groundwater depletion, Controversies on major dams – resettlement and rehabilitation of people: problems and concerns, Rain water harvesting, cloud seeding and watershed management. Economy and Environment, The economy and environment interaction, Economics of development, preservation and conservation, Sustainability: theory and practices, Limits to growth, Equitable use of resources for sustainable life styles, Environmental Impact Assessment.

Text Books

1. Environmental Science - Y. Anjaneyulu, B S Publications.
2. Environmental studies-Deeksha dave, Cengage learning India Pvt. Ltd.,
3. Environmental sciences and Engineering - P. Venugopal Rao, PHI learning Pvt. Ltd.,
4. Environmental Science and Technology by M. Anji Reddy, B S Publications.

Reference books

1. Clark, R.S., Marine Pollution, Clanderson Press, Oxford, 2002.
2. Cunningham, W.P., et al., Environmental Encyclopedia, Jaico Publishing House, Mumbai, 2003.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year B.Tech.– II Sem, Common to all branches	**L**	**T/P/D**	**C**
	3	**1**	**3**

(13MTH002) LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

Course prerequisites: Matrices, Differentiation and Integration

Course Objectives:

- Understand the Echolen form and Normal form of a matrix and its applications in solving linear system of equations.
- Understand the methods of solving first order differential equations and learn about its applications to L-R and R-C circuits.
- Apply the convolution theorem to evaluate Laplace Transform of the functions.
- Apply Z-Transforms in solving the difference equations.

Course Outcomes: Students will be able to:

- Find the rank using Echolen form and Normal form.
- Solve the problems in first order and second order differential equations.
- Learn Laplace Transform as a tool.
- Evaluate the Z-Transform of the given function.

UNIT-I

LINEAR ALGEBRA – MATRICES

Rank of matrix, Hermitian and skew – Hermitian matrices, Inverse of matrix by elementary operations. Consistency of linear simultaneous equations, Eigen values and eigen vectors, Diagonalisation of a matrix(including the case of repeated eigen values). Caley – Hamilton theorem (without proof), Quadratic forms - reduction of quadratic form to canonical form by linear transformation.

UNIT-II

ORDINARY DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS

Differential equations of first order and first degree - Exact differential equation , Linear and Bernoulli differential equation, Applications of differential equations of first order and first degree - Newton's law of cooling, Law of natural growth and decay, Orthogonal trajectories, and basic circuits(L-R Circuits, R-C Circuits).

UNIT-III

DIFFERENTIAL EQUATIONS OF HIGHER ORDER AND THEIR APPLICATIONS

Differential equations of higher order - homogeneous and non-homogenous type, differential equations of second order and higher order with constant coefficients with right hand side term of the type e^{ax} sin (ax), cos (ax), polynomials in x, e^{ax}, V(x), x V(x) and method of variation of parameters ; Euler-Cauchy's 2^{nd} order

differential equations, applications to spring mass system ,Simple harmonic motion and L-C-R Circuits.

UNIT-IV

LAPLACE TRANSFORMS

Existence condition, Laplace transform of standard functions, Properties, Inverse Laplace transform of functions using partial fractions, Convolution theorem(statement only). Solving linear differential equations using Laplace transform. Unit step function, Impulse function and Periodic function and their transforms.

UNIT- V

Z-TRANSFORMS

z-transform; Inverse z-transform; Properties, initial, and final value theorems; Convolution theorem(theorems without proofs); Difference equations; Solutions of difference equations using z-transform.

TEXT BOOKS :

1. Higher Engineering Mathematics – B. S. Grewal,Khanna publishers.
2. A First Course in Differential Equations by Dennis G. Zill; Publisher: Brooks Cole publiers.
3. Advanced Engineering Mathematics by R.K.Jain and S.R.K.Iyengar; Narosa Publications.

REFERENCES :

1. Advanced Engineering Mathematics by Erwin Kreyszig, 8th Edition; Publisher: John Wiley.
2. Advanced Engineering Mathematics by Peter V. O'Neil, 9th Edition; Publisher: Cengage Learning

VNR Vignana Jyothi Institute of Engineering and Technology

I Year B. Tech ME / AE II Sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(13PHY002) PHYSICS OF MATERIALS

Course Objectives:

- To learn the structure of solids, crystal systems, packing and arrangement of particles in crystals, simple planes and directions in solids, defects in crystals.
- To learn the properties of magnetic materials and classification, Dielectric materials.
- To learn the concept and applications of superconductors.
- To introduce new concepts like surface phenomena and nano science.

Course Outcomes:

Students will be able to:

- Identify different crystal types various planes and directions in crystals and estimate one dimentional crystal defects.
- Learn the magnetic properties of materials classify the magnetic materials into Dia, Para and ferro.
- Learn the characteristics, properties and applications of superconductors and magnetic materials.
- Realize surface phenomena are different from bulk; learn methods to estimate work functions. and Compare optical and electron microscopes and learn principles of SEM&TEM.

UNIT - I

CRYSTAL STRUCTURES:

Space lattice – Unit cell – Lattice parameters – Crystal systems – Bravais lattice- Atomic radius – Co-ordination number - Structures and Packing fractions of Simple Cubic – Body Centered Cubic – Face Centered Cubic – Hexagonally closed packed & diamond Cubic Crystals.

BONDING IN SOLIDS:

Force and energy between two approaching atoms, primary and secondary bonds, binding energy and cohesive energy, Madelung constant, cohesive energy and Madelung constant for NaCl crystal

UNIT -II

DIRECTIONS, PLANES AND X-RD:

Miller Indices for Crystal planes and directions – Inter planar spacing of orthogonal crystal systems –Diffraction of X-rays by crystal planes and Bragg's law– Laue method – Powder method.

DEFECTS IN SOLIDS:

Imperfections in crystals – Point defects (Vacancies, Interstitial and Impurities) Schottky and Frenkel defects – (with mathematical treatment)- Line imperfections – Edge and Screw dislocation – Burger vector – Surface defects and volume defects (Qualitative Treatment).

UNIT - III

MAGNETIC PROPERTIES OF MATERIALS:

Permeability, Field intensity, magnetic field induction, Magnetization and Magnetic susceptibility – Origin of magnetic moment, Bohr magneton – Classification of magnetic materials (Dia, Para and Ferro)- Domain theory of ferromagnetism, Hysteresis curve – Soft and Hard magnetic materials – Ferrites and their applications.

UNIT - IV

DIELECTRIC PROPERTIES:

Electric dipole, Dipole moment, Dielectric constant, Electronic, Ionic and Orientation Polarization – Calculation of Polarizibilities – Internal fields – Claussius – Mossotti equation –Piezo and Ferro electricity

SUPERCONDUCTORS:

Experimental survey and superconductivity phenomenon, – Meissner effect – Critical fields and Persistent currents, Type I and Type II superconductors - London equations-flux quantization, Applications of Superconductors.

UNIT - V

SCIENCE & TECHNOLOGY OF NANOMATERIALS:

Work function, Thermionic emission, Contact Potential, Electron Microscope, Scanning Tunneling Microscope. Origin of nano science – (Basic principles of Nanoscience & Technology) surface to volume ratio, quantum confinement – Fabrication of nano materials, Bottom up fabrication: sol-gel & combustion methods – Top down fabrication: CVD& PVD methods– Applications of nanotechnology.

TEXT BOOKS:

1. Introduction to Solid State Physics by Charles Kittel (Publishers: John Wiley & Sons)
2. Applied Physics by P.K.Mittal, IK International Publishing House (P) Ltd

REFERENCES:

1. Solid State Physics by A.J.Dekker; Macmillan Publishers India Lt.
2. Engineering Physics by G Sahashra Buddhe; University Press
3. Elements of Solid State Physics by J.P.Srivatsva, PHI Publishers
4. Engineering Physics by M.R.Srinivasan, New Age Publishers
5. Solid State Physics by M.A. Wahab.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year B.Tech CE, ME, AE, ECE, EEE, EIE – II Sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(13CHE001) ENGINEERING CHEMISTRY

Course Prerequisites: General Chemistry

Course Objectives:

- Understand electrochemistry which deals with the utilization of electrical energy of an external source for bringing about a physical or chemical change.
- Knowledge of "Corrosion engineering education" and Usage of polymers in modern world as an integral part of every human's life.
- Knowledge of purification techniques and various applications of soft water in industries.
- Usage of nanomaterials as emerging scientific components with amazing potential applications in various fields.

Course Outcomes:

Students will be able to:

- Visualize the chemical applications of electricity.
- Prevention of corrosion of metals and applications of polymers from domestic articles to sophisticated scientific and medical instruments.
- Benefits of treated water as source in steam generation and other fields like production of steel, paper, textiles, atomic energy etc.
- The applicability and greater efficiency of using a material at nanoscale in different
- Engineering fields.

UNIT I

Electrochemical cells and batteries

Conductance-factors effecting conductance, conductometric titrations; cells: types of cells, cell representation, electrode potential; Standard electrode potential; Electrochemical series; Nernst equation; Reference electrodes – hydrogen, calomel electrode; Ion selective electrodes (glass electrode & flouride electrode); Numerical problems.

Batteries

Primary and secondary cells (lead-acid cell; Ni-Cd cell; lithium cells); Applications of batteries; Fuel cells – methanol – oxygen fuel cells, advantages of fuel cells; Solar cells - principle, and applications.

UNIT II

Corrosion and its control

Introduction; Causes and effects of corrosion; Different types of corrosion; Theories of corrosion – chemical, electrochemical corrosion (reactions); Factors affecting corrosion – nature of metal (galvanic series; over voltage; purity of metal; nature of oxide film; nature of corrosion product), and nature of environment (effect of temperature; effect of pH; humidity; effect of oxidant).Corrosion control methods – cathodic protection, sacrificial anode, and impressed current cathode; Surface coatings – methods of application on metals (hot dipping; galvanizing; tinning; cladding; electroplating), and organic surface coatings (paints - constituents and functions).

UNIT III

III a) Polymers

Introduction**;** Types of polymerization; Plastics - thermoplastic resins, and thermoset resins; Compounding & fabrication of plastics; Preparation, properties, and engineering applications of polyethylene, PVC, PS, Teflon, bakelite, nylon.

III b) Rubber

Natural rubber- processing, vulcanization; Elastomers (Buna-s; Butyl rubber; Thiokol rubbers); Fiber reinforced plastics (FRP) and their applications.

UNIT IV

Water

Introduction; Hardness - causes, expression of hardness, units, types of hardness, estimation of temporary & permanent hardness of water, and numerical problems; Boiler troubles – scale & sludge formation, caustic embrittlement, corrosion, priming & foaming; Softening of water (Internal & external treatment - lime soda, zeolite, ion exchange process, and numerical problems); Reverse osmosis and Electro dialysis (desalination processes).

UNIT V

Nanomaterials

Introduction; Preparation and applications of nanomaterials with special reference to carbon nanotubes.

Insulators

Classification of insulators; characteristics of thermal & electrical insulators and their applications; Superconductors - $YBa_2 Cu_3 O_{7-x}$; Applications of superconductors.

TEXT BOOKS

1. Text Book of Engineering Chemistry by Y.Bharathi Kumari, Jyotsna Cherukuri; Publisher: VGS Book Links.
2. Engineering Chemistry by P.C.Jain & Monica Jain, Publisher: Dhanpatrai Publishing Company.

REFERENCES

1. Text Book of Engineering Chemistry by S.S. Dhara & Mukkanti; Publisher: S.Chand & Co.
2. Engineering Chemistry by O G Palanna.
3. Text Book of Engineering Chemistry by R.Gopalan, D.Venkappayya, Sulochana Nagarajan Vikas Publishers.
4. Engineering Chemistry by R.P.Mani, S.N. Mishra, B.Rama Devi, Cengage Learning Publications.

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I Year B.Tech (Common to all Branches)	**L**	**T/P/D**	**C**
	3	**0**	**3**

(13ENG001) ENGLISH

Introduction

This is the age of information and communication technologies. Engineers and technical professionals need to convey technical information in English for various purposes.

Besides learning general English as an international language, engineering students need to be equipped with adequate writing ability so that they can communicate technical information clearly on at least a basic level. A good English writing proficiency can be a contributing factor to professional recognition and career prospects. This course teaches those writing strategies that scientists, engineers, and others will need in order to write successfully on the job. It initiates the students into Technical Writing. The purposes of technical writing are to inform and persuade. This program aims to train students in writing clear, concise and effective English.

This Syllabus is therefore, a Pragmatic English Writing Program for engineering students with intermediate proficiency. The program covers a syllabus outline and instructional approaches on basic writing skills with particular reference to technical writing.

Course Objectives:

- To equip the students with all the LSRW skills for advanced writing and speaking.
- To equip the students with basic grammar, infrastructural patterns and grammatical constructions required in technical writing as well as oral presentation.
- To acquaint the students with the writing process in preparation for academic and workplace writing.

Course Outcomes:

Students will be able to:

- Comprehend technical writing produced in the engineering profession.
- Understand the writing process and create logical paragraphs.
- Use infrastructural patterns in writing and speaking.

Methodology

A Task-based, process oriented methodology will be used by the teachers to give a practical orientation to the teaching of language. An inductive approach will be used to demonstrate the use of language in context. This should enable the students to internalize the language structures and vocabulary used in context. Students will be

exposed to numerous examples and ample practice will be given in the contextual use of language structures.

Syllabus Outline

Unit I : Review of Grammar

i) Common Errors
ii) Subject-Verb Agreement
iii) Adverbs
iv) Transitional elements
v) Use of Articles and Prepositions
vi) Conjunctions
vii) pronoun reference

Unit II : Prose 1

1. Heaven's Gate by Pico Iyer
2. The Connoisseur by Nergis Dalal

Unit III Reading and Writing Skills

i) Reading Comprehension -- Skimming & scanning
ii) Reading Comprehension -- Intensive reading
iii) Reading Comprehension -- Critical Analysis
iv) Paragraph Writing
v) Letter Writing
vi) Memo Writing

Unit IV : Prose 2

1. The Cuddalore Experience by Anu George
2. The Odds Against Us by Satyajit Ray

Unit V : Advanced Writing Skills

1. Comparison and Contrast Pattern
2. Cause and Effect Pattern
3. Classification
4. Analogy
5. Problem-Solution Pattern

Prescribed Text Books

1. **Enjoying Everyday English** by A. Ramakrishna Rao
2. **Effective Technical Communication** by Ashraf Rizvi
3. **Technical Writing Process and Product** by Gerson Sharon J. and Steven Gerson. 3rd edition, New Jersey: Prentice Hall 1999

References

1. M. Raman and S. Sharma, 2004; Technical Communication : Principles and Practices, OUP, (Indian Edition)
2. Blanton, L.L. 1993; Composition Practice, Book 4 ,Second Edition, Heinle & Heinle Publishers, pp. 54
3. Georges, T.M. 1996; A course in Analytical Writing for Science and Technology, http://www.mspiggy.etl.noaa.gov/write/

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I Year B. Tech ME / AE II Sem	**L**	**T/P/D**	**C**
	4	**1**	**4**

(13MED002) ENGINEERING MECHANICS – II

Course Prerequisite: Physics, Mathematics, Engineering Mechanics – I

Course Objectives:

- Understand trusses and their analysis using various methods.
- Understanding principle of virtual work and its applications.
- Understanding kinematics and kinetics parts of machines.

Course Outcomes:

Students will be able to:

- Draw the Free Body Diagram of a truss acted upon by a system of forces and analyze the truss.
- Identify elements of virtual work and analyze them.
- Identify various links of machines and synthesize kinematics and kinetic parts of design components.

UNIT – I

TRUSSES:

Introduction –Types of Trusses, Assumptions made in the analysis of Trusses, Method of Joints, Method of Sections, Force table, Cantilever Trusses, Trusses with one end hinged and the other freely supported on rollers carrying horizontal or inclined loads. Frames: Introduction, Types of Frames, Method of members.

UNIT – II

VIRTUAL WORK:

Equilibrium of ideal systems, Virtual displacement, Concept of virtual work, Principle of virtual work, Application of principle of virtual work to beams, ladders, framed structures.

UNIT – III

KINEMATICS:

Kinematics of particles - Path, Tortuous path, Plane path, Rectilinear motion, Displacement, Displacement time diagram, Velocity, Instantaneous velocity, Average velocity, Velocity time diagram, Acceleration, Variable acceleration, Average acceleration, Curvilinear motions, normal and tangential accelerations, Projectiles, Kinematics of rigid bodies rotation about a fixed axis

UNIT - IV

KINETICS:

Kinetics of particles, Newton's Second Law, differential equations of rectilinear and curvilinear motions, motion of a particle acted upon by constant force, Dynamic equilibrium, Inertia force, D'Alembert's Principle applied for rectilinear and curvilinear motion, Kinetics of rigid bodies in rotation under action of a constant moment.

UNIT – V

WORK–ENERGY, IMPULSE–MOMENTUM METHOD:

Work of a force, Principle of Work and Energy, Application of principle of Work-Energy for rectilinear motion, Impulse-Momentum Principle, Application of Impulse-Momentum principle to connected bodies. Moment of momentum, Application of principle of Work-Energy for curvilinear motion.

TEXT BOOKS:

1. Engineering Mechanics by Timoshenko and Young, Tata Mc-Graw Hill Publishers.
2. Engineering Mechanics by S.S. Bhavikatti, New age International Publishers.
3. Engineering Mechanics by R.K. Bansal, Laxmi Publishers.

REFERENCES:

1. Singer's Engineering Mechanics by K. Vijaya Kumar Reddy, BS Publishers.
2. Engineering Mechanics (Statics) by Meriam and Kraige, John Wiley Publishers.
3. Engineering Mechanics by Tayal, Umesh Publishers.

VNR Vignana Jyothi Institute of Engineering and Technology

I Year B.Tech ME / AE II Sem	**L**	**T/P/D**	**C**
	0	**6**	**3**

(13MED102) ENGINEERING GRAPHICS – II (USING AUTOCAD)

Course Prerequisites: Engineering Graphics -I

Course Objectives:

- Understand the concept of section of solids, development of surfaces, intersection of surfaces.
- Learn the various types of projections- orthographic and pictorial.
- Understand the importance and the principles of perspective projections.

Course Outcomes:

Students will be able to:

- Construct the true shape of section and also obtain the development of surfaces of various solids using AutoCAD.
- Obtain the intersection of surfaces of solids like prism, cyclinder and cone, using AutoCAD.
- Visualize the objects and convert them in different projections – orthographic, isometric and pictorial using AutoCAD.

UNIT I

SECTIONS AND SECTIONAL VIEWS

Sections of right regular solids-prisms, pyramids, cylinders and cones – auxiliary views.

DEVELOPMENT OF SURFACES

Development of surfaces of right regular solids prisms, pyramids, cylinders and cones.

UNIT II

INTERSECTION OF SOLIDS

Intersection of prism vs prism, cylinder vs prism, cylinder vs cylinder and cylinder vs cone.

UNIT III

ISOMETRIC PROJECTIONS

Principles of isometric projections, isometric scale, isometric views, conventions, isometric views of lines, planes, simple and compound solids, isometric views of objects having spherical parts.

UNIT IV

TRANSFORMATION OF PROJECTIONS

Conversion of isometric views to orthographic views - conventions for simple objects. Construction of orthographic projections for given isometric projections.

UNIT V

PERSPECTIVE PROJECTIONS

Perspective view of points, lines, plane figures and simple solids, vanishing point method and visual ray method.

TEXT BOOKS:

1. Elementary Engineering Drawing by N.D.Bhat; Publisher: Charotar Publishing House.
2. Engineering Drawing by K.L. Narayana and P. Kannaiah; Publisher: Scitech Publications.
3. Engineering Graphics for degree by K.C. John; Publisher: Prentice Hall of India.

VNR Vignana Jyothi Institute of Engineering and Technology

I Year B.Tech ME / AE II Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13MED103) IT AND ENGINEERING WORKSHOP

Course Prerequisites:

Course Objectives:

- To study/demonstrate the concepts of computer w.r.t. its hardware, operating system, assembling and disassembling.
- To conduct the experiments related to production engineering technology.
- To demonstrate the usage of power tools, CNC lathe and machine shop for different exercises.

Course Outcomes:

Students will be able to:

- Identify, assemble, dissemble, install and write commands for a given configuration of a computer.
- To develop components using the techniques of carpentry, tin smithy, forging, etc. listed in trades for exercises.
- To work out the given models in machine shop and CNC lathe.

IT WORKSHOP

1. Computer Hardware: Identification of Peripherals
2. Assembling and disassembling of a PC
3. Simple diagnostic exercises – Related to hardware
4. Installation of Windows Operating System
5. Installation of Linux Operating System
6. Linux Basic Commands
7. Simple diagnostic exercises –Related to Operating System

TEXTBOOKS:

1. IT Essentials PC Hardware and Software Companion Guide Third Edition by Davis Anfinson and Ken Quamme CISC Press, Pearson Education.
2. PC Hardware and A+ Handbook – Kate J. Chase PHI (Microsoft)

ENGINEERING WORKSHOP

TRADES FOR EXCERCISES

At least **two** exercises from each trade:

1. Carpentry
2. Tin-Smithy
3. Fitting
4. Welding
5. Electrical Wiring

TRADES FOR DEMONSTRATION and EXPOSURE:

1. Power tools in construction, wood working, electrical engineering and mechanical engineering.
2. Machine shop.
3. CNC Lathe.

TEXT BOOKS:

1. Workshop Manual by P.Kannaiah and K.L.Narayana; Publisher: Scitech.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year B.Tech (Common to all branches)	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13ENG101) ENGLISH LANGUAGE COMMUNICATION SKILLS LABORATORY

The English language Communication Skills Lab aims to provide practice in all the four skills of LSRW, with a special emphasis on listening and speaking skills.

Course Objectives

- Provide ample practice in LSRW skills.
- Provide practice in grammatical construction, structural patterns, word usage and improve comprehension abilities in the students.
- Train students to use neutral pronunciation through phonetic sounds, symbols, stress and intonation.
- Enable students to transfer information from verbal to graphic representation and vice versa.
- Train students to use effective language for oral presentations, public speaking, role play and situational dialogue.

Course Outcomes

- Comprehend spoken and written discourse.
- Speak fluently with neutral pronunciation and exhibit interpersonal skills.
- Write accurately, coherently and lucidly making appropriate use of words depending on context and present data clearly.
- Introduce one self to people and be able to speak extempore.

Syllabus for Lab Sessions

Unit 1

Multimedia Lab

1. Grammar : Nouns and Pronouns; Articles; The Present Tense
2. Vocabulary Lesson 1
3. Listening Comprehension

Communication Skills Lab: Introduction of Self and others

Unit 2

Multimedia Lab:

1. Grammar: Concord; Adjectives; The Past Tense
2. Vocabulary: Lesson 2
3. Listening Skills

Communication Skills Lab: Seeking and Giving Information, Giving and Taking Instructions.

Unit 3

Multimedia Lab

1. Grammar --- Adverbs, Conjunctions, Prepositions; The Future Tense
2. Vocabulary Lesson 3
3. Telephoning Skills

Communication Skills Lab: Role Play/ Situational Dialogues

Unit 4

Multimedia Lab:

1. Grammar ---- Active and Passive Voice; Language Analysis
2. Vocabulary : Lesson 4
3. Listening Comprehension

Communication Skills Lab: i) JAM/ Short Talk ii) Information Transfer a) Interpretation of Graph

Unit 5

Multimedia Lab:

1. **Introduction to Technical Writing**
   A. Definition of a Technical Term
   B. Description of a Mechanism
   C. Description of a Technical Process
2. Vocabulary : Lesson 5

Communication Skills Lab : Presentation Skills: Oral Presentation

Multimedia Lab Requirements

The English Language Lab shall have two parts:

i) The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.

ii) The Communication Skills Lab with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

iii) System Requirement (Hardware component):

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

i) P – IV Processor
ii) Speed – 2.8 GHZ
iii) RAM – 512 MB Minimum
iv) Hard Disk – 80 GB
v) Headphones of High quality

iv) Suggested Software:

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

List of Software:

- **Clarity Pronunciation Power** – part II
- **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)

VNR Vignana Jyothi Institute of Engineering & Technology

II Year I Sem B.Tech (EEE, ME&AME)	**L**	**T/P/D**	**C**
	3	**1**	**3**

(13MTH005) PARTIAL DIFFERENTIAL EQUATIONS WITH APPLICATIONS AND COMPLEX ANALYSIS

Course prerequisites: Differentiation, integration.

Course Objectives:

- Derive the Fourier coefficients for the sine and cosine series.
- Apply Separation of Variables to solve elementary examples of linear second order Partial Differential Equations (heat , Laplace and wave equations).
- Understand the properties of Fourier transforms.
- Apply Cauchy theorem, Cauchy's Integral formula, Residue theorem of complex functions.

Course Outcomes:

Students will be able to:

- Solve the second order linear partial differential equations by using separation of variables method.
- Solve problems in Fourier half range sine and cosine series.
- Evaluate simple problems of finite Fourier sine and cosine transforms, Inverse Fourier sine and cosine transform problems and apply to heat, wave and Laplace equations.
- Evaluate the line integrals using residue theorem, Cauchy's theorem and Cauchy's integral formula.

Unit-I

Fourier Series: Fourier Series of periodic functions, Euler's formulae, Fourier series of even and odd functions, having arbitrary periods, half range Fourier series.

Unit-II

Fourier Transforms: Fourier transform, Sine and Cosine transforms and their properties , Finite fourier Transforms and Parsavel's Identity.

Unit-III

Standard Partial Differential Equations:

Method of seperation of variables, Applications :Problems of vibrating string- wave equation, Problems of one-dimensional heat equation, Problems of steady state two dimensional heat flow-Laplace equation.

UNIT – IV

Functions of a complex variable: Functions of a complex variable, Continuity, Differentiability, Analyticity, Cauchy-Riemann equations in Cartesian and polar coordinates, Harmonic and conjugate harmonic functions, Milne – Thompson method. Exponential, trigonometric, hyperbolic functions and their properties, z^c and Logz .

UNIT – V

Integration of complex function, Power series and Residues:

Line integral, evaluation along a path and by indefinite integration. Cauchy's integral theorem, Cauchy's integral formula. Expansion of Taylor's series and Laurent series (without proofs). Singular point, Isolated singular point, pole of order m , essential singularity. Residues – Evaluation of residue by formulae, Residue theorem, Evaluation of real integrals.

TEXT BOOKS:

1. Higher Engineering Mathematics – B. S. Grewal,Khanna publishers.
2. Complex Variables & Its Applications- Churchill and Brown, (1996), International Edition, McGraw Hill.

REFERENCES:

1. Advance Engineering Mathematics - Peter O'Neil,(2000),5th Edition, Cengage Learning.
2. Schaum's Outline Of Complex Variables - Murray.R.Spiegel,(2011), 2nd Edition, Tata McGraw Hill.

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II Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
	4	**1**	**4**

(13MED003) MECHANICS OF SOLIDS

Course Prerequisites: Maths, Physics and Engineering Mechanics

Course Objectives:

- Understand Material properties and relationship between them.
- Understand the principles of Mechanics, Stress and Strain,
- Under Stand thoroughly the concepts o f principal stresses applied to solid structural members and mohr's circle diagram.
- Understand the mechanical engineering problems concern to bending of beams, torsion of shafts etc.

Course Outcomes:

Students will be able to:

- Formulate equations with appropriate assumptions.
- Develop model and analyze solid mechanics problems.
- Application of concepts of principal stresses in real life design issues
- Design and develop beams, shats for various applications

UNIT I

TENSION, COMPRESSION, AND SHEAR

Introduction; Normal Stress and Strain; Stress-strain diagrams; Elasticity and plasticity; Linear elasticity and Hooke's law; Allowable stress and allowable loads.

AXIALLY LOADED MEMBERS

Introduction; Deflections of axially loaded members; Strain energy; Dynamic loading.

THERMAL STRESSES

UNIT II

SHEAR FORCE AND BENDING MOMENT DIAGRAMS

Types of beams; Types of loading; Shear force and bending moment; Relationship between load, shear force and bending moment; Shear force and bending moment diagrams.

TORSION

Introduction; Torsion of circular bars; Non uniform torsion; Pure shear; Relationship between modulus of elasticity E and G; Transmission of power by circular shafts.

UNIT III

Area moment of inertia of composite sections.

STRESSES IN BEAMS

Introduction; Normal strains in beams; Normal stresses in beams; Cross-sectional shapes of beams-C, angular and semicircle structures; Shear stresses in rectangular

beams; Shear stress in webs of beams with flanges; Shear stress in circular beams (solid and hollow sections); Concept of shear center and shear flow.

UNIT IV

ANALYSIS OF STRESS AND STRAIN

Introduction; Plane stress; Principal stresses and maximum shear stresses; Mohr's circle for plane stress; Hooke's law for plane stress; Spherical and cylindrical pressure vessels (biaxial stress; Hoop and longitudinal stresses); Combined loadings (plane stress); Principal stresses in beams.

UNIT V

DEFLECTIONS OF BEAMS

Introduction; Differential equations of the deflection curve; Deflections by integration of the bending moment equation; Deflections by integration of the shear-force and load equations; Macaulay's method; Moment area method; Method of superposition.

TEXT BOOK:

1. Mechanics of Materials (SI units) by J.M.Gere and S.P.Timoshenko; Publisher: CBS Publishers.

REFERENCE:

1. Engineering Mechanics of Solids by Popov; Publisher: Pearson Education.

2. Strength of Materials Schaum's Series.

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II Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
	4	**1**	**4**

(13MED004) THERMODYNAMICS

Course Prerequisites: Physics

Course Objectives:

- To understand the basic concepts of thermodynamics and Thermodynamic Laws.
- To apply the thermodynamic laws and principles in the fields of energy technology.
- To understand real world thermal engineering applications.

Course Outcomes: Students will be able to

- Apply thermodynamic Laws to real world problems.
- Adopt, apply and analyse thermodynamic cycles for various applications.
- Design an appropriate thermodynamic system.

UNIT I

CONCEPTS AND DEFINITIONS

Thermodynamic system and control volume; Macroscopic versus microscopic point of view; Properties and state of a substance; Processes and cycles, Energy, Specific volume and density, Equality of temperature; The Zeroth law of thermodynamics; Temperature scales.

WORK AND HEAT

Definition of work; Units for work; Work done at the moving boundary of a simple compressible system; Other systems that involve work; Definition of heat; Heat transfer modes; Comparison of heat and work.

THE FIRST LAW OF THERMODYNAMICS

The first law of thermodynamics for a control mass undergoing a cycle; The first law of thermodynamics for a change in state of a control mass; Internal energy-a thermodynamic property; Problem analysis and solution technique; Enthalpy; The constant-volume and constant-pressure specific heats; The internal energy, enthalpy, and specific heat of ideal gases; The first law as a rate equation.

FIRST LAW ANALYSIS FOR A CONTROL VOLUME

Conversion of mass and the control volume, The first law of thermodynamics for a control volume, The steady-state process; Examples of steady-state processes.

UNIT II

THE SECOND LAW OF THERMODYNAMICS

Heat engines and refrigerators; The second law of thermodynamics; The reversible process; Factors that render processes irreversible; The Carnot cycle; Two propositions regarding the efficiency of a Carnot cycle; The thermodynamic temperature scale; The ideal-gas temperature scale; Ideal versus real machines.

ENTROPY FOR A CONTROL MASS

The inequality of Clausius; Entropy — a property of a system; The entropy of a pure substance; Entropy change in reversible processes; The thermodynamic property relation; Entropy change of an ideal gas; The reversible polytropic process for an ideal gas; Entropy change of a control mass during an irreversible process; Entropy generation; Principle of increase of entropy; Entropy as a rate equation.

UNIT III

IRREVERSIBILITY AND AVAILABILITY

Available energy; Reversible work and irreversibility; Availability and second-law efficiency; Exergy balance equation.

Introduction to Third law of Thermodynamics & Concept of absolute entropy.

PROPERTIES OF A PURE SUBSTANCE

The pure substance; Vapor- liquid- solid- phase equilibrium in a pure substance; Independent properties of a pure substance; Steam Tables; Thermodynamic surfaces; The compressibility factor; Equations of state.

UNIT IV

POWER CYCLES

Introduction to power systems; The Rankine cycle; Effect of pressure and temperature on the Rankine cycle; Air-standard power cycles; The Brayton cycle; The air-standard cycle for jet propulsion; Reciprocating engine power cycles; The Otto cycle; The Diesel cycle; The Dual cycle, The Stirling cycle; The Atkinson and Miller cycles.

UNIT V

IDEAL GAS MIXTURES

General consideration and mixtures of ideal gases; ideal gas equation Daltons law of partial pressure

THERMODYNAMIC PROPERTY RELATIONS

Mathematical relations for a homogeneous phase; The Maxwell relations; Thermodynamic relations involving enthalpy, internal energy, and entropy; The Clapeyron equation; Joule-Thompson coefficient; Real gas behavior and equations of state; The generalized chart for changes of enthalpy at constant temperature; The property relation for mixtures; Tables of thermodynamic properties of gases.

TEXT BOOK:

1. Fundamentals of Thermodynamics by C. Borgnakke and R.E. Sonntag; Publisher Wiley India Pvt. Ltd.
2. Engineering Thermodynamics by P.K. Nag, Publisher: McGraw-Hill.

REFERENCES:

1. Fundamentals of Thermodynamics by C. Borgnakke, R.E. Sonntag, and G.J. Van Wylen; Publisher John Wiley.
2. Engineering Thermodynamics by Burgadt, Harper & Row Publication.
3. Thermodynamics — An engineering approach by Yunus Cengel and Boles; Publisher: TMH.

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II Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
	4	**0**	**4**

(13MED005) METALLURGY AND MATERIAL SCIENCE

Course Prerequisites: Maths, Physics and Chemistry

Course Objectives:

- Understand the microstructures of different types of metal and alloys –cast iron, steels, non ferrous metal and alloys.
- Understand the heat treatment principles-annealing, normalizing and hardening.
- Understand the different types of tools.

Course Outcomes:

Students will be able to:

- Distinguish different types of metals and alloys.
- Design a heat treatment process to change the properties-hardness, ductility, etc.
- Analyze the failure of metals and alloys.

UNIT I

METAL STRUCTURE AND CRYSTALLIZATION

Introduction - atom binding, ionic bond, covalent bond, metallic bond, and Vander Waals forces; Crystal imperfections.

OVERVIEW OF METAL STRUCTURE AND CRYSTALLIZATION. **CONSTITUTION OF ALLOYS**

Introduction; Classification of alloys or compounds; Pure metal; Intermediate alloy phase or compound - intermetallic compounds or valency compounds, interstitial compounds, and electron compounds; Solid solutions; Substitution solid solution - factors that control the range of solubility in alloy system; Interstitial solid solutions.

UNIT II

PHASE DIAGRAMS

Introduction; Coordinates of phase diagrams; Experimental methods - construction of equilibrium diagrams by thermal analysis, metallographic methods, and X-ray diffraction;

Type-I-Two metals completely soluble in the liquid and solid states; Chemical composition of phases; relative amounts of each phase; Equilibrium cooling of a solid solution alloy; Diffusion; Nonequilibrium cooling; Homogenization; Properties of solid-solution alloys; Variation of Type I; Type II-Two metals completely soluble in the liquid state and completely insoluble in the solid state; Type III-Two metals completely soluble in the liquid state but only partly soluble in the solid state; Properties of eutectic alloy systems; Age hardening – solution treatment, and aging process; Type IV-The

congruent-melting intermediate phase; Type V-The peritectic reaction; Type VI-Two liquids partly soluble in the liquid state: the monotectic reaction; Type VII-two metals insoluble in the liquid and solid states; Interrelation of basic types;

Transformations in the solid state - allotropy, order-disorder transformation, the eutectoid reaction, the peritectoid reaction, and complex diagrams;

Study of important binary phase diagrams of Cu-Ni, Al-Si, Sb-Pb, Pt-Ag, Bi-Cd, Cu-Pb, Cu-Sn and Fe- Fe_3C.

UNIT III

THE HEAT TREATMENT OF STEEL

Introduction; Full Annealing; Spheroidizing; Stress-relief annealing; Process annealing; Normalizing; Hardening; The isothermal transformation diagram; Transformation to Pearlite and Bainite; Cooling curves and I-T Diagram; Transformation on continuous cooling; Position of the I-T curves; Hardening or austenitizing temperature; Homogeneity of austenite; Mechanism of heat removal during quenching - vapor-blanket cooling state (stage A), vapor transport cooling stage (stage B), Liquid cooling stage (stage C); Quenching medium; Temperature of quenching medium; Surface condition - methods to minimize the formation of scale - copper plating, protective atmosphere, liquid-salt pots, and cast-iron chips; Size and Mass; Hardenability; Use of Hardenability data; Tempering; Austempering; Surface heat treatment or case hardening; Carburizing; Heat treatment after carburizing; Cyaniding and Carbonitriding; Nitriding; Flame hardening; Induction Hardening; Residual Stresses; Hardenable carbon steels; Effect of cryogenic heat treatment – A brief study.

UNIT IV

ALLOY STEELS

Introduction; Purpose of alloying; Effect of alloying elements upon Ferrite; Effect of alloying elements upon carbide; Influence of alloying elements on the iron-iron carbide diagram; Effect of alloying elements in tampering; Classification of steels - nickel steel, chromium steel, nickel-chromium steels, manganese steels, molybdenum steels, tungsten steels, vanadium steels, silicon steels, stainless steels, martensitic stainless steels, ferritic stainless steels, austenitic stainless steels, precipitation-hardening stainless steels, maraging steels, and ausforming.

TOOL STEELS

Classification of tool steels; Selection of tool steels; Comparative properties; Non-deforming properties; Depth of hardening; Toughness; Wear resistance; Red-hardness; Machinability; Resistance to decarburization; Brand names; Water-hardening tool steels (Group W); Shock resisting tool steels (Group S); Cold-work tool steels; Hot-work tool steels (Group H); High speed tool steels; Mold Steels (Group P); Special purpose tool steels; Heat treatment of tool steels; Overview of tool failures;

Special cutting materials – satellites, cemented carbides, and ceramic tools.

UNIT V

CAST IRON

Introduction; Types of cast iron; White cast iron; Malleable cast iron; Pearlitic malleable iron; Gray cast iron; Silicon in cast iron; Sulfur in cast iron; Manganese in cast iron; Phosphorus in cast iron; Heat treatment of grey iron, Size and distribution of graphite flakes; Mechanical properties and applications of grey cast iron; Chilled cast iron; Nodular cast iron; Alloy cast irons.

NON-FERROUS METALS AND ALLOYS

Introduction; Copper and its alloys - Copper, temper designation of copper and copper alloys, and copper alloys; Aluminum and its alloys - Aluminum, Alloy designation system, and temper designation; Titanium and Titanium alloys.

TEXT BOOK:

1. Introduction to Physical Metallurgy by Sidney H. Avner; Publisher: McGraw-Hill.

REFERENCES:

1. Essentials of Materials Science and Engineering by Donald R. Askeland and Thomson.
2. Materials Science and Engineering by William and Collister.
3. Elements of Materials Science by V.Raghavan.
4. Materials Science and Metallurgy by Kodigiri.

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II Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
	4	**1**	**4**

(13MED006) FLUID MECHANICS & HYDRAULIC MACHINES

Course Prerequisites: Maths, Physics and Engineering Mechanics

Course Objectives:

- Understand the properties of fluids, principles of buoyancy, flow, force and head calculations.
- Understand boundary layer principles applied to aerofoiles.
- Principles of operation of different types of hydraulic machinery.

Course Outcomes:

Students will be able to:

- Apply the knowledge of fluids and properties to solve flow, force and velocity problems.
- Apply the knowledge of fluid flow and dynamics in solving problems in hydraulic machines.
- Perform model analysis of hydraulic machinery and select appropriate machines for hydro power plant.

UNIT I:

Fluid Statics: Properties of fluid – specific gravity, viscosity, surface tension, vapor pressure and their influence on fluid motion, Pressure at a point, measurement of pressure, Forces on immersed surfaces, Center of pressure, Buoyancy, Elements of stability of floating bodies.

Fluid Kinematics: Classification of flows, acceleration equations, Stream line, path line and streak lines and stream tube, continuity equation, Stream function, velocity potential function.

UNIT II:

Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equation, Venturimeter, Orifice meter, Pitot tube, Reynolds experiment –Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel. Momentum equation, force on pipe bend.

UNIT III:

Boundary Layer Theory: Development of boundary layer along a thin flat plate, Laminar boundary layer and turbulent boundary layer, Laminar sub layer, boundary layer separation, Drag and lift forces - Aerofoils, pressure and form drags.

Impact of Jets: Hydrodynamic force of jets on flat, inclined and curved vanes - jet striking centrally and at tip, flow over radial vanes.

UNIT IV:

Hydraulic Turbines: Classification of turbines, design of Pelton wheel, Francis turbine and Kaplan turbine – working proportion, work done, efficiency, draft tube- theory, functions and efficiency. Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank and water hammer, elements of hydropower plant.

UNIT V:

Hydraulic Pumps: Classification, centrifugal pumps – types, working, work done, manometric head, losses and efficiency, specific speed – pumps in series and parallel – performance characteristic curves, NPSH, Reciprocating Pump – types, Working, Discharge, slip, indicator diagrams.

TEXT BOOK:

1. Hydraulics and Fluid Mechanics Including Hydraulics Machines: Dr. P.N.Modi, Dr. S.M. Seth

REFERENCE BOOKS:

1. Fluid mechanics V. L. Streeter & E. B. Wylie.
2. Fluid mechanics, fundamentals & applications - Yunus A. Çengel, John M. Cimbala.
3. Fluid mechanics: F. M. White
4. Introduction to Fluid Mechanics, R. W. Fox, A. T. McDonald and P.J Pritchard.
5. Fundamentals of fluid mechanics: Bruce Roy Munson, Donald F. Young, Theodore H. Okiishi, Wade W. Huebsch Wiley Publication.

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II Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13MED104) METALLURGY AND MATERIAL SCIENCE LAB

Course Prerequisites: Metallurgy and material science

Course Objectives:

- Understand the need of proper simplification for different materials.
- Understand the significance microstructure of different materials under microscopic testing.
- Understand the changes in microstructures after different treatments.

Course Outcomes:

Students will be able to:

- Identify materials for micro structure.
- Test microstructure of any given material and predict properties.
- Prepare appropriate heat treatment for a given material by checking its microstructure.

Metallurgy lab (Six experiments)

1. Preparation and study of the microstructure of metals like Iron, Cu and Al.
2. Preparation and study of the microstructure of mild steels, low carbon steels, and high carbon steels.
3. Study of the microstructures of cast irons.
4. Study of the microstructures of non-ferrous alloys.
5. Study of the microstructures of heat treated steels.
6. Harden ability of steels by Jiminy end quench test.
7. To find out the hardness of various treated and untreated steels.
8. Study the microstructure of cutting tools.
9. study the micro structures of stainless steel.
10. study the different crystal structures of metals.

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II Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13MED105) MECHANICS OF SOLIDS LAB

Course Prerequisites: Mechanics of solids, Engineering Mechanics

Course Objectives:

- Understand various tests to be conducted on engineering materials.
- Understand the significance of tests on evaluating the corresponding mechanical properties.
- Understand the importance of technical parameters used during tests.
- Understand the real time applications of the tests conducted.

Course Outcomes:

Students will be able to:

- Correlate the theoretical concepts by conducting the tests on different materials.
- Plot the result of test and comment on the mechanical properties of materials.
- Decide a material and an appropriate test suitable for given application.
- Understand the significance of the tests in different fields of engineering.

Mechanics of Solids lab

1. Direct tension test
2. Bending tests:
   a) Simple supported beam
   b) Cantilever beam
3. Torsion test
4. Hardness test
   a) Brunel hardness test
   b) Rockwell hardness test
5. Test on springs
6. Compression test on a cube
7. Impact test
8. Punch shear test
9. Mechanical advantage :
   (a) Simple screw jack
   (b) Compound screw jack
10. Moment of Inertia of a fly wheel
11. To Study various types of Strain Gauges

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II Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13MED106) FLUID MECHANICS AND HYDRAULIC MACHINES LAB

Course Prerequisites: Fluid Mechanics& Hydraulic Machines course

Course Objectives:

- Conduct the experiments to understand the concept, find the values and obtain the result of experiments.
- Apply fundamental principles of fluid mechanics for the solution of practical mechanical engineering problems of water conveyance in pipes, orifices, mouth pieces, notches & weirs.
- Understand various pumps, water turbines, pipes and pressure measurement devices.

Course Outcomes:

Students will be able to:

- Model and analyse fluid flow problems in mechanical engineering.
- Conduct experiments in pipe flows and open-channel flows and interpreting data from model studies to prototype cases.
- Correlate the experimental results with theoretical concepts.

Any 10 experiments to be conducted from the following**:**

1. Verification of Bernoulli's theorem
2. Calibration of Venturimeter/ Orifice meter.
3. Calibration of t notches.
4. Determination of friction factor for a given pipe.
5. Determination of Minor losses for the given equipment
6. Impact of jets on vanes.
7. Performance test on Pelton wheel.
8. Performance test on Francis turbine.
9. Performance test on Kaplan turbine.
10. Performance test on single stage centrifugal pump.
11. Performance test on multi stage centrifugal pump.
12. Performance test on reciprocating pump.

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II Year II Sem B.Tech (All branches except EEE)	**L**	**T/P/D**	**C**
	3	**1**	**3**

(13MTH003) NUMERICAL ANALYSIS AND LINEAR PROGRAMMING

Course prerequisites: Elementary row transformations of matrices, differentiation and integration.

Course objectives:

- Understand the numerical methods for non linear systems, evaluating definite integrals and ordinary differential equations.
- Understand various methods of interpolation.
- Understand the simplex method and methods to solve the transportation problem.

Course outcomes:

Student will be able to:

- Apply the numerical methods to find a root of algebraic and transcendental equations.
- Apply the numerical methods to find the solutions of ordinary differential equations.
- Use simplex method procedure to optimize a linear function.
- Solve transportation problems

UNIT I

Solutions of non-linear systems:

Introduction; Mathematical preliminaries; Solution of algebraic and transcendental equations – the iteration method , the bisection method, the method of false position, ,Newton - Raphson method, and their order of convergence.

UNIT II

Interpolation:

Introduction; Errors in polynomial interpolation; Finite differences; Forward differences; Backward differences; Central differences; Symbolic relations and separation of symbols; Differences of a polynomial; Newton's formulae for interpolation; Central difference interpolation formulae; Gauss's central difference formulae; Lagrange and Hermite interpolation formulae.

UNIT III

Numerical differentiation and Integration:

Numerical differentiation based on interpolation ,Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, and Simpson's 3/8 rule.

Numerical solutions of ordinary differential equations:

Solution of initial value problems by Taylor's series - Picard's method of successive approximations, Euler's method, and Runge - Kutta methods; Predictor Corrector

methods - Adams Bashforth method- Adams Moulton method and Milne's method (without proofs).

UNIT IV

Linear programming

Basic concepts; problem formulation, graphical method, canonical and standard forms of LPP simplex method, Artificial variables technique- Big-M method,

UNIT V

Transportation problems:

Balanced and Unbalanced transportation problems- North-West corner rule, Least cost method, Vogel's approximation method (VAM) and MODI method.

TEXT BOOKS

1. Elementary Numerical Analysis – B.S. Grewal, 3rd edition Publisher: Khanna Publishers
2. Operations Research - Taha H.A, Publisher: Mcmillan Publishing:

REFERENCES

1. Advanced Engineering Mathematics by Erwin Kreyszig, 8th Edition; Publisher: John Wiley and Sons.
2. Elementary Numerical Analysis – an algorithmic approach -Samuel D. Conte and Carl De Boor (2006); 3rd edition; Publisher: Tata McGraw Hill 3. Operations Research – by S.D. Gupta
3. Operations Research- Kantiswaroop , P.K Gupta and Manmohan, 4th edition, Publisher: Sultan Chand & Sons.

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II Year B.Tech ME II Sem	**L**	**T/P/D**	**C**
	4	**0**	**4**

(13CMS001)BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

Course Objectives:

- To explain different forms of organizing private and public sector business enterprises and to analyze the significance of Business Economics in solving the problems of business enterprise. Also to define and analyze the concepts of Demand, Elasticity of Demand and Demand Forecasting Methods.
- To analyze the various types of costs and to determine the level of output at which there is neither profit nor loss. To estimate capital requirements and to describe various sources of mobilizing funds. Also to identify least cost combinations of inputs produce desired quantity of output.
- To describe the features of different market structure and pricing strategies.
- To explain the basic accounting concepts and conventions. To elaborate the importance of finance function for evaluating the economic status of a business unit.

Course Outcomes

Students will be able to:

- Select the suitable form of business organization which meets the requirement of selected business also perform decision – making function effectively in an uncertain frame work by applying concepts of Managerial Economics. Meet and manipulate the demand efficiently and plan the future course of action.
- Apply right kind cost to reduce cost by paying attention towards the costs which can be reduced. Take decision whether to buy or produce? Reduce the cost of capital by selecting best source of fund mobilization and select best investment opportunity which yields higher rate of return.
- Fix the right price which can best meets the predetermined objectives of the business firm under different market conditions. Able to select best combination of inputs to produce required quantity of output.
- Prepare books of accounts and know over all financial position of the business enterprise which enables the concerned to take appropriate measures to improve the situation. Also interpret the financial position from difference angles and initiates the measures/ efforts in that direction.

UNIT - I

BUSINESS AND NEW ECONOMIC ENVIRONMENT

Characteristic features of business; Features and evaluation of sole proprietorship; Partnership; Joint stock company; Public enterprises and their types; Changing business environment in post- liberalization scenario.

UNIT - II

INTRODUCTION TO BUSINESS ECONOMICS AND DEMAND ANALYSIS

Definition; Nature and scope of managerial economics - demand analysis determinants; Law of demand and its exceptions.

ELASTICITY OF DEMAND AND DEMAND FORECASTING

Definition; Types; Measurement and significance of elasticity of demand; Demand forecasting; Factors governing demand forecasting; Methods of demand forecasting - Survey methods, statistical methods, Expert opinion method, Test marketing, Controlled experiments, and Judgmental approach to demand forecasting.

UNIT - III

COST ANALYSIS

Cost concepts - Opportunity cost, Fixed vs. Variable costs, Explicit costs vs. Implicit costs, and Out of pocket costs vs. Imputed costs; Break-even analysis (BEA) - determination of break-even point (simple problems), managerial significance, and limitations of BEA.

CAPITAL AND CAPITAL BUDGETING

Capital and its significance; Types of capital; Estimation of fixed and working capital requirements; Methods and sources of raising finance.

Nature and scope of 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 - IV

THEORY OF PRODUCTION

Production function - isoquants and isocosts, least cost combination of inputs, and laws of returns; Internal and external economies of scale.

MARKET STRUCTURES

Types of competition; Features of perfect competition, Monopoly, and Monopolistic competition; Price-output determination in case of perfect competition and Monopoly.

PRICING POLICIES AND METHODS

Cost plus pricing; Marginal cost pricing; Sealed bid pricing; Going rate pricing, Limit pricing, Market skimming pricing, Penetration pricing, Two-part pricing, Block pricing, Bundling pricing, Peak load pricing, Cross subsidization.

UNIT V

INTRODUCTION TO FINANCIAL ACCOUNTING

Double-entry book keeping; Journal; Ledger; Trial balance; Final accounts - trading account, profit and loss account and balance sheet with simple adjustments.

FINANCIAL ANALYSIS THROUGH RATIOS

Computation; Analysis and interpretation of liquidity ratios - current ratios, and quick ratio; Activity ratios - Inventory Turnover ratio, and Debtor Turnover ratio; Capital structure ratios – Debt-Equity ratio, and Interest Coverage Ratio; Profitability ratios - Gross profit Ratio, Net Profit Ratio, Operating Ratio, P/E ratio and EPs.

TEXT BOOKS

1) Varshney & Maheswari: Managerial Economics , Sultan Chand, 2009.
2) Aryasri: Managerial; Economics and Financial Analysis, TMH, 2009.

REFERENCE BOOKS

1) Ambriah Gupta, Financial Accou8nting for Management, Pearson Education, New Delhi, 2010.
2) H.Craig Peterson & W. Cris Lewis, Managerial Economics PHI, 2010.

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II Year B.Tech ME II Sem	**L**	**T/P/D**	**C**
	4	**0**	**4**

(13MED007) KINEMATICS OF MACHINERY

Course Prerequisites: Geometrical construction, Engineering Mechanics.

Course Objectives:

- Understand mechanisms for motion transmission.
- Understand the construction methods for drawing velocity and acceleration diagrams.
- Design engineering applications involving in selection, sizing of mechanism to accomplish motion objectives.
- Understand the mechanism involving cams, gears and gear trains

Course Outcomes:

Student will be able to:

- Draw velocity and acceleration diagrams of various parts of a machine along with the transmission Mechanisms.
- Design components of machine parts, structures, gears, cams, belts, pulleys, etc. for kinematic analysis.
- Understand the straight line motion mechanisms, Hooke's joint and steering mechanisms.
- Design the mechanisms after analysis for safety and efficient working.

UNIT-I

MECHANISMS AND MACHINES:

Elements or links-classification-rigid link, flexible and fluid link-types of kinematic pairs-sliding pairs, turning, rolling, screw and spherical pairs-lower and higher pairs-closed and open pairs-constrained motion-completely, partially or successfully constrained and incompletely constrained.

Mechanisms, Machines -classification of machines- kinematic chain-inversion of mechanism-inversions of quadric cycle chain, single and double slider crank chains, Intermittent motion mechanisms.

UNIT-II

KINEMATICS:

Velocity and acceleration-motion of link in machine-Construction of velocity and acceleration diagrams-graphical method- Application of relative velocity method- four bar chain.

ANALYSIS OF MECHANISMS:

Analysis of slider crank chain for displacement, velocity and acceleration of slider-acceleration diagram for a given mechanism, Klein's construction, Coriolis acceleration, determination of Coriolis component of acceleration.

PLANE MOTION OF BODY:

Instantaneous center of rotation, centroids and axodes - relative motion between two bodies-Three centers in line theorem-Graphical determination of instantaneous centre,analysis of simple mechanisms and determination of linear velocity and angular velocity of links.

UNIT-III

MECHANISMS AND HOOKE'S JOINT:

Condition for correct steering –Davis steering gear, Ackerman's steering gear-velocity - ratio - Single and double Hooke's Joint- Universal coupling-applications- problems.

STRAIGHT LINE MOTION MECHANISMS:

Exact and approximate-copied and generated types - Peaucellier , Hart and Scott Russell- Grasshopper- Watt-Tchebicheff and Robert mechanism and straight line motion, Pantograph.

UNIT-IV

CAMS:

Definition of cam and followers-their uses-types of followers and cams-terminology-types of follower motion-uniform velocity-simple harmonic motion and uniform acceleration, maximum velocity and acceleration during outward and return strokes in the above three cases. Overview of polynomial motions, Analysis of motion of followers: roller follower- circular cam with straight, concave and convex flanks.

UNIT-V

HIGHER PAIRS:

Friction wheels and toothed gears-types-law of gearing, condition for constant velocity ratio for transmission of motion, forms of teeth- Cycloidal and Involute profiles. Velocity of sliding-phenomena of interference-methods of interference, condition for minimum number of teeth to avoid interference, expression for arc of contact and path of contact-introduction to helical, bevel and worm gearing.

GEAR TRAINS:

Introduction-train value-types-simple, compound and reverted wheel trains – epicyclic gear train, methods of finding train value or velocity ratio-selection of gear box differential gear for an automobile.

TEXT BOOKS:

1. Theory of Machines by Thomas Bevan.
2. Theory of Machines by P. L. Ballaney.
3. Theory of Machines by Ratan.

REFERENCES:

1. Theory of machines by R. S. Khurmi & J. K. Gupta.
2. Theory of machines by R. K. Bansal.
3. Theory of machines by Sadhu Singh.
4. Theory of machines by Shigley.
5. Mechanism and Machine Theory by J. S. Rao and R. V. Dukkipati.

VNR Vignana Jyothi Institute of Engineering and Technology

II Year B.Tech ME II Sem	**L**	**T/P/D**	**C**
	4	**0**	**4**

(13MED008) THERMAL ENGINEERING

Course Prerequisite: Mathematics, Physics.

Course Objectives:

- Understand the air-standard and actual cycles in I.C.Engines.
- Understand the working principle, method of carburetion, fuel injection and ignition systems.
- Understand working principle of reciprocating compressors and refrigeration and air conditioning systems.

Course Outcomes:

Students will be able to:

- Design of automobile refrigeration and Air conditioning systems.
- Conduct experiments in evaluating the performance parameters and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.
- Understand or become aware of disasters caused by an incorrect analysis in automobile, refrigeration and air-conditioning systems.

UNIT – I

ACTUAL CYCLES AND THEIR ANALYSIS

Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust blow down, Loss due to Gas exchange process, Volumetric Efficiency, Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of I.C. Engines.

UNIT – II

I. C. ENGINES

Classification, Working principles, Valve and Port Timing Diagrams, Air Standard, air-fuel and actual cycles, Engine systems; Fuel Systems, Simple Carburetor, Solex carburetor, Fuel Injection Systems; Ignition systems, Battery ignition, Magneto ignition, Modern ignition systems; Transistorized coil ignition (TCI) system, Capacitive Discharge Ignition (CDI) System, Cooling and Lubrication systems.

UNIT – III

COMBUSTION IN S. I. ENGINES

Homogeneous mixture, Heterogeneous mixture, Stages of combustion, Flame front propagation, Factors influencing the flame speed, Rate of pressure rise, Abnormal combustion, Phenomenon of Knock, Types of Combustion chambers, Fuel requirements and fuel rating

COMBUSTION IN C. I. ENGINES

Combustion process, stages of combustion, Delay period and its importance, Factors affecting Delay period, Diesel Knock, Comparison of Knock in C.I and S.I engine, Combustion chambers in C.I. Engine, Fuel requirements and fuel rating.

UNIT – IV

TESTING AND PERFORMANCE

Measurement and Testing; Friction power, Indicated power, Brake power, Fuel consumption, Air consumption, Emissions Performance parameters; Engine power, Engine efficiencies, Engine performance characteristics, Heat Balance.

RECIPROCATING AIR COMPRESSORS

Classification; Reciprocating Compressor: Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency and effect of clearance, Multi stage compression with inter cooling, Saving of work, Minimum work condition for stage compression.

UNIT –V

INTRODUCTION TO REFRIGERATION CYCLE AND PSYCHROMETRIC PROPERTIES

Refrigeration cycles - Vapor compression refrigeration cycle, Bell Colman refrigeration cycle, Vapour Absorption Refrigeration System

Psychrometric properties - Dry bulb temperature, Wet bulb temperature, Dew point temperature, Specific humidity, Relative humidity, Degree of saturation, Specific enthalpy, Psychrometric chart, Psychrometric processes.

TEXT BOOKS:

1. I. C. Engines by V. Ganesan; Publisher: Tata McGraw Hill.
2. Thermal Engineering by Mahesh M. Rathore; Publisher: Tata McGraw Hill.

REFERENCES:

1. Refrigeration & Air Conditioning by C.P. Arora; Tata McGraw Hill.
2. I.C. Engines by Heywood; Publisher: Tata McGraw Hill.
3. Thermal Engineering by Rajput; Publisher: Lakshmi Publication.

VNR Vignana Jyothi Institute of Engineering and Technology

II Year B.Tech ME, AME – II Sem	**L**	**T/P/D**	**C**
	3	**1**	**3**

(13EEE079) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Course Objectives:

- To get awareness of using mechanical energy for electrical energy generation.
- To understand the basic operation of circuits used for automobile control.
- To know about working of different electrical machines used for propulsion of vehicles.
- To know the basic operation of diode and transistor.

Course Outcomes

Upon completion of this course, the student will be able to

- Analyze the electro-mechanical energy conversion using electrical machines.
- Analyze the different electrical machines used for propulsion of vehicles.
- Analyze different control circuits which involve different circuits' parameters.
- Analyze the operation of transistor and CRT

UNIT - I

ELECTRICAL CIRCUITS: Circuit Concept R-L-C parameters-Ohm's law - Kirchhoff's laws - Series - Parallel resistive networks - Star/delta transformations.

AC Circuits : Average value, rms value, form factor of sinusoidal function, R-L, R-C and R-L-C circuits- Concept of Power factor, Real and reactive powers simple problems.

UNIT - II

DC MACHINES: Principle of operation of DC Generator – emf equation - types – Principle of operation of DC Motor - DC motor types –torque equation – Three point starter -Swinburne's test, applications.

TRANSFORMERS: Principle of operation of single phase transformer–emf equation–losses–OC and SC tests - efficiency and regulation

UNIT - III

AC MACHINES: Principle of operation of alternator – regulation by synchronous impedance method –Principle of operation of induction motor – slip – torque characteristics – applications.

INSTRUMENTS: Principle and construction of permanent magnet moving coil and moving iron instruments.

UNIT - IV

DIODE AND IT'S CHARACTERISTICS: P-n junction diode, symbol, V-I Characteristics, Diode Applications: Rectifiers – Half wave Full wave and Bridge rectifiers (simple Problems)

UNIT - V

TRANSISTORS: PNP and NPN Junction transistor, Transistor as an amplifier, SCR characteristics and applications.

CATHODE RAY OSCILLOSCOPE: Principles of CRT (Cathode Ray Tube), Deflection, Sensitivity, Electrostatic and Magnetic deflection, Applications of CRO - Voltage, Current and frequency measurements.

TEXT BOOKS:

1. Electronic Devices and Circuits David A Bell Oxford University Press.
2. Introduction to Electrical Engineering – M.S Naidu and S. Kamakshaiah, TMH Publications.

REFERENCES:

1. Principles of Electrical and Electronics Engineering by V.K.Mehta, S.Chand & Co.
2. Basic Electrical Engineering by Kothari and Nagarath, TMH Publications, 2nd edition.

VNR Vignana Jyothi Institute of Engineering and Technology

II Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
	0	**6**	**3**

(13MED107) MACHINE DRAWING

Course Prerequisites: Engineering Graphics

Course Objectives:

- Understand the Principles of Machine Drawing Conventions.
- Understand the Machine Elements like Screw Threads, Nuts, Bolts, Keys, and Shafts & Bearings.
- Understand the different views of Part Drawings and based on that, draw the Assembled Parts of Engine & Machine parts.

Course Outcomes:

Students will be able to:

- Apply the Knowledge of Machine Drawing Conventions.
- Use the Autocad Software and draw the Machine Elements like Screw Threads, Nuts, Bolts, Keys, Shafts & Bearings.
- Design all the parts & assemble them in AutoCad with section views.

Machine drawing conventions

Need for drawing conventions – Introduction to IS conventions

a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs.
b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
c) Methods of dimensioning, general rules for sizes, and placement of dimensions for holes, centers, and curved and tapered features.
d) Title boxes, their size, location, and other details - common abbreviations and their liberal usage.
e) Types of drawings – working drawings for machine parts.

I. Drawing of machine elements and simple parts

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

a) Popular forms of screw threads, bolts, nuts, stud bolts.
b) Keys, cottered joints, and knuckle joint.
c) Riveted joints for plates.
d) Shaft coupling and spigot joint.
e) Journal, pivot, and collar bearings.

II. Assembly drawings

Assembly drawings for the following, using conventions and easy drawing proportions:

a) Engine parts – stuffing boxes, eccentrics, I.C. engine connecting rod and piston assembly.

b) Other parts - screws jacks, machine vices, and tailstock.

NOTE

1. To adopt first angle of projection.
2. The student should be able to provide working drawings of actual parts.

TEXT BOOK:

1. Machine Drawing by K. L. Narayana, P. Kannaiah and K. Venkata Reddy; Publisher: New Age/ Publishers.

REFERENCES:

1. Machine Drawing by Siddheswar, Kannaiah and Sastry.
2. Machine Drawing by N. D. Bhatt.

VNR Vignana Jyothi Institute of Engineering and Technology

II Year B.Tech ME II Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13MED108) THERMAL ENGINEERING LAB

Course Prerequisites: Thermodynamics, Thermal Engineering

Course Objectives:

- Understand how thermodynamic cycles work
- To understand working principal of thermal devices.
- Conduct performance test under various conditions and draw performance curve.

Course Outcomes:

Students will be able to

- Draw actual cycles and compare it with theoretical cycles to understand losses.
- Will be able to understand the mechanical and thermodynamic limitations of obtaining ideal performance.
- Will be able to analyze any given engine and evaluate its performance.

Syllabus:

Any 10 experiments to be conducted from the following**:**

1. I.C. Engines Valve / Port Timing Diagrams.
2. I.C. Engines Performance Test (4 -Stroke Diesel Engines).
3. I.C. Engines Performance Test on 2-Stroke Petrol Engines.
4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Petrol.
5. I.C. Engines Heat Balance.
6. I.C.Engines Air/Fuel Ratio and Volumetric Efficiency.
7. Performance Test on Reciprocating Air – Compressor Unit
8. Study of Boilers.
9. Dis-assembly / Assembly of Engines.
10. Determination of optimum cooling water temperature on I.C.Engine.
11. Performance test on Air conditioning Test Rig.
12. Performance test on Refrigeration test rig.

VNR Vignana Jyothi Institute of Engineering and Technology

II Year B.Tech ME, AME – I I Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13EEE179) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

Course Objectives:

- Understand the performance of D.C Shunt Machine.
- Understand the performance of AC machines.
- Understand the performance and efficiency / regulation of electrical machines are determined experimentally.
- Understand the operation of solid state devices like diode, transistor and SCR.

Course Outcomes:

Upon completion of this course, the student will be able to

- Find the application of electrical machines with the experimental determination of the performance of the machines.
- Find the application of Induction motor with the experimental determination of the performance of the machines.
- Find the application of single phase transformer.
- Identify the characteristics of all solid state devices.

Section A: Electrical Engineering:

The following experiments are required to be conducted as compulsory experiments:

1. Swinburne's test on D.C. Shunt machine. (Predetermination of efficiency of a given D.C. Shunt machine working as motor and generator)
2. Brake test on D.C Shunt Motor
3. OC and SC tests on single phase transformer(Predetermination of efficiency and regulation at given power factors)
4. Brake test on 3-phase Induction motor (Determination of performance characteristics)
5. Regulation of alternator by Synchronous impedance method

Section B: Electronics Engineering:

The following experiments are required to be conducted as compulsory experiments:

1. P-n Diode Characteristics
2. Transistor CE Characteristics (Input and Output)
3. Full wave Rectifier with and without filters
4. CE Amplifiers
5. SCR Characteristics

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III Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
	3	**0**	**3**

(13MED009) PRODUCTION TECHNOLOGY

Course Prerequisites: Material science, Manufacturing Science.

Course Objectives:

- Understand metal joining techniques.
- Understand the principles involved in ferrous and non-ferrous casting design
- Understand cold and hot working of metals and processing of non-metals like plastics.

Course Outcomes:

Students will be able to

- Design castings taking into considerations of different moulds and their preparations.
- Design different welded joints applying it to different welding processes and able to conduct different types of tests on weld mates.
- Produce various work pieces using cold and hot working of a metal.

UNIT – I

CASTING:

Steps involved in making a casting; Advantage of casting and its applications; Pattern and core making; Types of patterns – Materials used for patterns; Pattern allowances and their construction; Principles of Gating, Gating ratio and design of gating systems. Solidification of casting; Concept; Solidification of pure metal and alloys; Risers; Types; Function and design; Casting design considerations; Quality testing and inspection of castings; Special casting processes; Centrifugal, Die, Investment casting; Melting furnaces.

UNIT – II

WELDING:

Classification of welding process types of welds and welded joints and their characteristics, design of welded joints, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma welding Inert Gas welding, TIG & MIG, welding, Friction stir welding, Induction welding, Explosive welding, Laser welding, Soldering & Brazing. Heat affected zones in welding; welding defects – causes and remedies – destructive and nondestructive testing of welds.

UNIT –III

MECHANICAL WORKING -1:

Hot working; Cold working; Strain hardening; Recovery; Recrystallisation and grain growth; Comparison of properties of cold and hot worked parts

ROLLING:

Rolling fundamentals; Theory of rolling; Types of Rolling mills and products; Forces in rolling and power requirements.

EXTRUSION:

Basic extrusion process and its characteristics; Hot extrusion and Cold extrusion; Forward extrusion and backward extrusion – Impact extrusion; Hydrostatic extrusion; Extrusion defects.

FORGING PROCESSES:

Principles of Forging; Tools and dies; Types of Forging; Smith forging; Drop Forging; Roll Forging; Forging hammers; Rotary Forging; Forging defects.

UNIT – IV

MECHANICAL WORKING -2:

Stamping, forming and other cold working processes : Blanking and piercing; Bending and forming; Drawing and its types; Wire drawing and Tube drawing; Coining; Hot and cold spinning; Types of presses and press tools; Forces and power requirement in the above operations.

UNIT – V

PLASTIC MATERIALS AND PROCESSES:

Types of plastics; Compression moulding; Injection moulding; Blow moulding; Film and Sheet forming; Thermoforming.

TEXT BOOK:

1. Manufacturing Technology by P.N. Rao

REFERENCES:

1. Production Technology by R.K. Jain
2. Manufacturing Engineering and Technology by Kalpak Jian S
3. Process and Materials of Manufacturing by Lindberg/PE
4. Principles of Metal Castings by Rosenthal.
5. Welding Process by Parmar
6. Production Technology by Sharma P C

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III Year B.Tech ME/ I Sem	**L**	**T/P/D**	**C**
	4	**1**	**4**

(13MED010) DYNAMICS OF MACHINERY

Course Prerequisites: Engineering mechanics, Kinematics of machinery.

Course Objectives:

- Study the construction methods like Klien's, velocity polygons, acceleration diagrams etc for drawing various mechanisms.
- Identify the significance of the principles of equilibrium, super position, virtual work& D'Alembert's principle.
- Familiarize with the methods of static &dynamic stability.

Course Outcomes:

Students will be able to

- Show the engineering applications involving the selection and design of machine components with respect to the forces developed.
- Check whether the proposed design is satisfactory.
- Analyze and design flywheels, governors and gyroscopes to withstand forces.

UNIT-I

PRECESSION:

Gyroscopes, effect of precessional motion on the stability of moving vehicles such as motor car, motor cycle, aeroplanes and ships.

STATIC AND DYNAMIC FORCE ANALYSIS OF PLANAR MECHANISMS: (NEGLECTING FRICTION)

Introduction-free body diagrams-conditions of equilibrium-two and three force members-Inertia forces and D'Alembert's principle-planar rotation about a fixed centre.

SYNTHESIS OF LINKAGES:

Three position synthesis- four position synthesis- precision positions-structural error-Chebyshev's spacing, Freudenstein's Equation, problems.

UNIT-II

CLUTCHES:

Friction clutches, Single disc or plate clutch, multiple disc clutch, cone clutch& centrifugal clutch.

BRAKES AND DYNAMOMETERS:

Simple block brakes, internal expanding brake, band brake of vehicle.

Dynamometers - absorption and transmission types- general description and method of operation.

UNIT-III

TURNING MOMENT DIAGRAMS AND FLYWHEELS:

TURNING MOMENT:

Inertia torque-angular velocity and acceleration of connecting rod, crank effort and torque diagrams- Fluctuation of energy-design of flywheels

GOVERNORS:

Watt, Porter and Proell governors, Spring loaded governors- Hartnell and Hartung with auxiliary springs, Sensitiveness, isochronism and hunting.

UNIT-IV

BALANCING:

Balancing of rotating masses – single and multiple-single and different planes-balancing of reciprocating masses-primary and secondary balancing- analytical and graphical methods.

UNBALANCED FORCES AND COUPLES:

Balancing of V, multi cylinder inline and radial engines for primary, secondary balancing and locomotive balancing.

UNIT-V

VIBRATIONS:

Free vibration of mass attached to a vertical spring - simple problems on forced damped vibration.Vibration isolation and transmissibility - Whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems.

TEXT BOOKS:

1. Theory of Machines by Thomas Bevan; Publisher: Pearson Education.
2. Theory of Machines by S. S. Ratan; Publisher: Tata McGraw Hill.

REFERENCES:

1. Theory of Machines and Mechanisms by P. L. Ballaney; Publisher: Khanna.
2. Mechanism and Machine Theory by J. S. Rao and R. V. Dukkipati; Publisher: New Age.
3. Kinematics and Dynamics of Machinery by R. L. Norton; Publisher: McGraw Hill.
4. Theory of Machines and Mechanisms by Uicker, Pennock & Shigley; Publisher: Oxford.

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III Year B.Tech ME I Sem	**L**	**T/P/D**	**C**
	4	**1**	**4**

(13MED011) MECHANICAL ENGINEERING DESIGN - I

Course Prerequisites: Maths, Physics, Engineering Mechanics, Solid Mechanics, Metallurgy & Materials Science, kinematics of Machinery.

Course Objectives:

- Understand different properties of Materials and relationship between them.
- Understand the principles of stress, strain and Principal stresses as applied to Solid bodies or structural and machine elements under loads.
- Understand to form mathematical equation and analyze problems by making appropriate assumptions and learn systematic engineering method to solve practical Design engineering problems.

Course Outcomes:

Students will be able to

- Model and analyze design problems in Mechanical and structural engineering.
- Apply knowledge of standard elements and their technical information available in the data bases and in designing machine elements.
- Predict modes of failure in materials or machine elements caused by different types of loads under operation.

UNIT I

ENGINEERING MATERIALS AND DESIGN CONSIDERATIONS

The Design Phase / Methodology, and identification of need, Evaluation and Presentation, Reliability and Product liability. Mechanical Properties of Engineering Materials, overall design considerations, Factor safety, Preferred Numbers. Standard and codes, design data handbook. Load, stress and critical sections in machine parts. Static strength, plastic deformation, temperature properties, Definition of stress, simple stress, combined stress, complex stress. Members subjected to axial, bending, torsion and shear loading, impact stresses, theories of static failure.

UNIT II

DESIGN AGAINST FLUCTUATING LOAD

Stress concentration, stress concentration factors, Reduction of stress concentration, fluctuating stresses. Fatigue strength, Endurance Limit, fatigue test, S-N diagrams for different structural materials. Low cycle and high cycle fatigue, Notch sensitivity, Design for finite and infinite life. Gerber theory Soderberg and Goodman lines for fatigue strength, modified Goodman theory.

UNIT III

DESIGN OF FASTERNERS

Temporary Fasteners (Bolted and Screwed Fasteners)

Bolted joints, bolted joint under initial loading, eccentrically loaded Bolted Joints under different static load conditions.

Permanent Fasteners (Riveted and Welded Fasteners)

Riveted Joints, eccentrically loaded Riveted Joints, Design of Boiler Riveted joints, and Welding symbols, butt and fillet welds, stress in the welded joints carries tension bending and shear loading, Design of various types of Welding joints and eccentrically loaded welded joints under different static load conditions.

UNIT IV

DESIGN OF FLEXIBLE MECHANICAL ELEMENTS

Belt Drives:

Introduction, classification of belts, belt materials, design of flat (rectangular) belts, ratio of belt tensions, V-Belts, power transmitted through V-Belt, design of V-Belts.

Springs:

Classification of springs, spring material, Design of helical, leaf, disc and tensional springs under constant loads and varying loads.

UNIT V

DESIGN OF SHAFTS AND KEYS

Transmission shafts, Design of solid and hollow shafts based on strength, rigidity. Flexible shafts, shaft and axles – key and classification of keys, stresses in the keys, design considerations, effect of key way on the shaft strength.

TEXT BOOKS:

1. Design of Machine Elements by Bhandari; Publisher: Tata McGraw Hill.
2. Mechanical Engineering Design by Shigley J. E and Mischke C. R; Publisher: Tata McGraw Hill.

REFERENCES:

1. Engineering design by George E Dieter; Publisher: McGraw Hill.
2. Machine Design - An Integrated Approach by Robert L.Norton; Publisher: Addison Wesley.
3. Fundamentals of Machine Component Design by Juvinall R. C and Marshek K. M; Publisher: John Wiley and Sons.

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III Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
	4	**1**	**4**

(13MED012) HEAT AND MASS TRANSFER

Course Prerequisites: Basic integral and differential calculus, thermodynamics

Course Objectives:

- To understand different modes of heat transfer in physical environment under various conditions.
- To develop the equations governing the phenomena of heat transfer.
- To apply these equations to analyze problems by making good assumptions and solve practical heat transfer problems.

Course Outcomes:

Students will be able to:

- Explain any physical heat transfer phenomena into simpler phenomena.
- Apply fundamental knowledge of mathematics to modeling and analysis of simple heat and mass transfer phenomena with proper initial and boundary conditions.
- Use the devices that transfer heat and measure their efficiency.

UNIT-I

INTRODUCTION:

Modes and mechanisms of heat transfer - Basic laws of heat transfer - Simple general discussion about applications of heat transfer. Conduction Heat Transfer: Fourier heat conduction 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 sphere - overall heat transfer coefficient - electrical analogy - Critical radius of insulation - variable Thermal conductivity - systems with heat sources or Heat generation - extended surfaces 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 - Concepts about hydrodynamic and thermal boundary layers - Buckingham Pi-Theorem and method, application for developing Semi - empirical non-dimensional

correlation for convection heat transfer - Significance of non -dimensional numbers - use of empirical correlations for convective heat transfer- Forced Convection: Flat plates and horizontal pipes. Free Convection: Vertical plates and pipes.

UNIT-IV

HEAT TRANSFER WITH PHASE CHANGE:

Heat transfer with boiling - pool boiling and film boiling - boiling curve for pool boiling - simple correlations for pool boiling - Condensation plates heat transfer: film wise and drop wise condensation - film condensation on vertical and horizontal cylinders using empirical correlations.

RADIATION HEAT TRANSFER:

Emission characteristics and laws of black-body radiation - incident radiation - 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 net works.

UNIT V

HEAT EXCHANGERS:

Classification of heat exchangers - overall and fouling resistance - problems using LMTD and NTU methods.

INTRODUCTION TO MASS TRANSFER:

Analogy between heat, mass and momentum transfer - classification: Diffusion and convective mass transfer processes - Examples - Fick's Law of diffusion simple problems for steady state molecular diffusion - Convection mass transfer coefficient - non-dimensional numbers of mass transfer analogous to convection heat transfer.

TEXTBOOKS:

1. Fundamentals of Engineering Heat and Mass Transfer by R.C. Sachdeva; Publisher: New Age International.
2. Heat and Mass Transfer Data book by C.P. Kothandaraman; Publisher: New Age.

REFERENCES:

1. Heat Transfer by OZSIK.
2. Heat Transfer by HOLMAN.
3. Heat Transfer by Sukhatme; Publisher: University Press.
4. Heat and Mass Transfer by D. S. Kumar.
5. Fundamentals of Heat & Mass Transfer by Incopera & Dewitt.

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III Year B.Tech ME I Sem	**L**	**T/P/D**	**C**
	3	**1**	**3**

(13MED013) TURBO MACHINERY

Course Prerequisites: Mathematics, Engineering Basics, Thermal Engineering Basics

Course Objectives:

- Understand various energy conversations that take place in a turbo machines.
- Understand the principles of turbo machines.
- Understand governing mathematical equations to perform theoretical calculations.

Course Outcomes:

Students will be able to:

- Model and analyze problems in turbo machines.
- Design a simple energy producing or effort reducing device using basic thermodynamics concepts.
- Suggest and improvements to minimize losses.

UNIT I

STEAM GENERATORS:

Introduction, Classification of Boilers , Working Principles of Fire Tube and Water Tube Boilers, Low Pressure boilers, High Pressure Boilers – Babcock and Wilcox , Lamont Boiler, Boiler draught and performance of boilers, Equivalent evaporation.

STEAM CONDENSORS:

Introduction, purpose and types of condensers. Efficiency of condenser, air pumps.

UNIT II

STEAM NOZZLES:

Functions of nozzle, applications, types, flow through nozzles, Thermodynamic analysis, assumptions, velocity at nozzle exit, Ideal and actual expansion in nozzle, velocity co-efficient, condition for maximum discharge, nozzle efficiency, Critical pressure ratio, Supersaturated flow and its effects, degree of super saturation, degree of under cooling, wilson line.

UNIT III

STEAM TURBINES:

Impulse turbine - Mechanical details, velocity diagram, effect of friction, power developed, axial thrust, diagram efficiency, Condition for maximum efficiency, Methods to reduce rotor speed - velocity compounding, pressure compounding, combined velocity and pressure compounding, velocity and pressure variation along the flow.

Reaction Turbine - Mechanical details, principle of operation, Thermodynamic analysis of a stage, Degree of reaction, velocity diagram, parson's reaction turbine, condition for maximum efficiency.

UNIT IV

ROTARY COMPRESSORS:

Working Principles of - Roots blower, vane blower and screw compressor.

CENTRIFUGAL COMPRESSORS:

Mechanical details and principle of operation, velocity and pressure variation. Energy transfer. Impeller blade shape-losses, slip factor, power input factor, pressure co-efficient and adiabatic co-efficient, velocity diagrams.

AXIAL FLOW COMPRESSORS:

Mechanical details and principle of operation, velocity triangles and energy transfer per stage, degree of reaction, work done factor, Isentropic efficiency, pressure rise calculations, Polytrophic efficiency.

UNIT V

GAS TURBINES:

Classification of Gas Turbines ,Ideal cycle, essential components ,parameters of performance, actual cycle , regeneration ,inter cooling and reheating, closed and semi closed cycles, merits and demerits, combustion chambers and turbines for Gas Turbine plants.

JET PROPULSION:

Principle of operation, Classification of Jet propulsion engines, working principles with schematic diagram and representation on T-s diagram, Thrust, Thrust power and propulsion efficiency. Needs and demands met by Turbo Jet Engines, 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 BOOK:

1. Thermal Engineering by Mahesh M. Rathore; Publisher: Tata McGraw Hill.

REFERENCES:

1. Gas Turbines by V. Ganesan; Publisher: Tata McGraw Hill.
2. Thermal Engineering by R.K Rajput; Publisher: Lakshmi Publications.
3. Thermal Engineering by P. L. Ballaney; Publisher: Khanna.
4. Fundamentals of Turbo Machinery by B. K. Venkanna; Publisher: Prentice Hall International.

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III Year B.Tech ME I Sem	**L**	**T/P/D**	**C**
	3	**1**	**3**

(13MED014) OPERATIONS RESEARCH

Course Prerequisites: Mathematics, Industrial Engineering

Course Objectives:

- To understand linear programming in practical and their practical use.
- Understanding the Theory of games, Replacement, Inventory and Queuing models and their solution methodology for solving problems.
- To understand the Dynamic programming and simulation models.

Course Outcomes:

Students will be able to:

- Formulate and solve Assignment, Transportation, Sequencing, Replacement, Inventory and Queuing problems.
- Formulate and solve Problems using Linear Programming.
- Apply dynamic programming problem solving and simulation models.

UNIT-I

INTRODUCTION:

Origin, Development-Definition-Characteristics and Phases-Types of OR models-applications, limitations.

ALLOCATION:

Linear Programming Problem Formulation- Graphical solution-Simplex method-Artificial variables technique-Two phase method, Big-M Method-Duality Principle.

UNIT-II

TRANSPORTATION PROBLEM:

Formulation-Optimal solution-unbalanced transportation problem-Degeneracy. Assignment problem-Formulation-Optimal solution-Variations of Assignment Problem-Travelling Salesman Problem.

Sequencing: Introduction-Flow Shop sequencing-n jobs through two machines-n jobs through three machines-Job shop sequencing-two jobs through m machines.

UNIT-III

REPLACEMENT:

Introduction-Replacement of items that deteriorate with time-when money value is not counted and counted-Replacement of items that fail completely, group replacement.

THEORY OF GAMES:

Introduction-Minimax (maximin) - criterion and optimal strategy-Solution of games with saddle points-Rectangular games without saddle points-principles of dominance-M X 2and 2 X n games-graphical method.

UNIT-IV

WAITING LINES:

Introduction**-**Single channel-Poisson arrivals-exponential service times-with infinite population and finite population models-Multichannel-Poisson arrivals-exponential service times with infinite population single channel Poisson arrivals.

INVENTORY:

Introduction-Single item-Deterministic models-Purchase inventory models with one price break and multiple price breaks-shortages not allowed-Stochastic models-demand may be discrete variable or continuous variable-Instantaneous production, Instantaneous demand and continuous demand and no set up cost-single period model.

UNIT-V

DYNAMIC PROGRAMMING:

Introduction-Terminology-Bellman's Principle of optimality- Applications of dynamic programming- shortest path problem-linear programming problem.

SIMULATION:

Definition-Types of simulation models-phases of simulation-applications of simulation-Inventory and Queuing problems-Advantages and Disadvantages-Brief Introduction of Simulation Languages.

TEXT BOOKS:

1. Operations Research by J.K.Sharma; Publisher: Mac Milan.
2. Operations Research by R. Pannerselvam; Publisher: Prentice Hall International.

REFERENCES:

1. Operations Research by A. M. Natarajan, P.Balasubramani, A.Tamilarasi; Publisher: Pearson Education.
2. Operations Research: Methods and Problems by Maurice Saseini, Arthur Yaspan and Lawrence Friedman.
3. Introduction to OR by Taha; Publisher: Prentice Hall International.
4. Operations Research by Wagner; Publisher: Prentice Hall International.
5. Operations Research by S.D.Sharma-Kedarnath.
6. O.R Wayne L. Winston by Thomson; Publisher: Brooks/Cole.
7. Introduction to O.R by Hiller and Liebermann; Publisher: Tata McGraw Hill.

VNR Vignana Jyothi Institute of Engineering and Technology

III Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13MED109) PRODUCTION TECHNOLOGY LAB

Course Prerequisites: Production Technology.

Course Objectives:

- Understand and evaluate casting techniques and sand properties.
- Understand different welding processes and their use.
- Understand different press working operations and plastic moulding.

Course Outcomes:

Students will be able to:

- Produce sand moulds for a casting.
- Weld different materials using appropriate process.
- Make objects by press operations and mould plastic components.

Minimum 12 exercises to be performed from the following:

METAL CASTING:

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

I. WELDING:

1. Arc Welding Lap and Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. MIG Welding - 1 Exercise
5. Plasma welding and Brazing - 2 Exercises

II. MECHANICAL PRESS WORKING:

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

III. PROCESSING OF PLASTICS:

1. Injection Moulding
2. Blow Moulding

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III Year B.Tech ME I Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13MED110) HEAT AND MASS TRANSFER LAB

Course Prerequisites: Heat and mass transfer, thermodynamics.

Course Objectives:

- Understand various modes of heat transfer experimentally.
- Understand calculations of heat transfer co-efficient in difference systems.
- Understand factors affecting the heat transfer rate.

Course Outcomes:

Students will be able to:

- Find out critical thickness of insulation to minimize heat lost.
- Build a simple heat exchanger which gives better cooling.
- Come up with innovative idea to build compact heat transfer device.

Syllabus:

Any 10 experiments to be conducted from the following:

1. Determination of Thermal Conductivity of given Metal Rod.
2. Determination of Stefan Boltzmann Constant.
3. Critical Heat Flux Apparatus.
4. Determination of Overall Heat Transfer coefficient of Composite Wall.
5. Heat Transfer through Lagged Pipe.
6. Determination of Heat Transfer coefficient in Forced Convection Apparatus.
7. Determination of Heat Transfer coefficient in Natural Convection Apparatus.
8. Thermal Conductivity of Insulating Powder.
9. Parallel and Counter Flow Heat Exchanger.
10. Emissivity measurement.
11. Study of two phase flow.
12. Heat Transfer in pin-fin.
13. Heat Transfer in Drop and Film Wise Condensation.

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III Year B.Tech ME II Sem	**L**	**T/P/D**	**C**
	4	**1**	**4**

(13MED015) MACHINE TOOLS

Course Prerequisites: Production Technology, Engineering Materials.

Course Objectives:

- Understand Material removal processes, classification of machine tools and types of cutting tools used for performing different operations.
- Understand the principle of working of lathe machine, special purpose lathe & construction, working of reciprocating machine tools, milling operations, grinding & finishing operations.
- Understanding the Need for going to Non-Traditional Machining process & necessity of jigs & fixtures.

Course Outcomes:

Students will be able to:

- Apply the knowledge of various cutting tools used for different machining process in manufacturing.
- Prepare a process sheet for a component to manufacturing.
- Analyze a component and prepare sequence of operations to be performed and the machine tool to be employed.

UNIT – I

INTRODUCTION

Material removal processes, Types of Machine Tools; Single and multi point cutting tools.

METAL CUTTING

Introduction, Chip Formation, Shear Zone, Orthogonal Cutting, Shear Angle and Its Relevance, Cutting Tool Materials, Thermal Aspects, Tool Wear and Tool Life, Surface Finish, Cutting Fluids, Empirical and Analytical Determination of Cutting Forces, Economics.

MACHINE TOOLS

Classification of Machine Tools, Generation and Forming, Methods of Generating Surfaces, Accuracy and Finish Achievable, Basic Elements of Machine Tools, Support Structures, Guideways, General Work Holding Methods.

UNIT – II

MACHINE TOOLS:

CENTRE LATHE

Introduction, Constructional Features of a Centre Lathe, Aids for Support and Location, Cutting Tools, Operations Performed in a Centre Lathe, Taper Turning Methods,

Thread Cutting Methods, Special Attachments, Machining Time and Power Estimation Typical Set-ups.

SPECIAL PURPOSE LATHES

Limitations of a Centre Lathe, Capstan and Turret Lathes, Automatic Lathes, Tooling Layout and CAM Design for Automatic Lathes.

RECIPROCATING MACHINE TOOLS

Introduction, Shaper, Planer, Slotter.

UNIT – III

MILLING

Introduction, Types of Milling Machines, Milling Cutters, Milling Operations, Dividing Head, Milling Mechanics, Machining Time Estimation, Special Set-ups.

HOLE MAKING OPERATIONS

Introduction, Drilling, Reaming, Boring, Tapping, Other Hole Making Operations

UNIT IV

GRINDING & SUPERFINISHING PROCESSES

Introduction, Grinding Wheel – Designation and Selection, Types of Grinding Machines, Grinding Process, Grinding Process Parameters, Creep Feed Grinding, Honing, Lapping, Other Finishing Processes

UNIT V

UNCONVENTIONAL MACHINING PROCESSES

Need for Unconventional Processes, Overview on Electric Discharge Machining, Electrochemical Machining, Ultrasonic Machining, Chemical Machining, Laser Beam Machining, Water Jet Machining & Abrasive Jet Machining.

OTHER MACHINE TOOLS

Over view of Sawing, Broaching, Gear Cutting.

JIGS AND FIXTURES

Introduction, Principles of design of Jigs and fixtures, Principles of location, Locating devices, Clamping devices, Typical examples of jigs and fixtures.

TEXT BOOKS:

1. Manufacturing Technology, Vol. 2, Metal Cutting and Machine Tools by P N Rao; Publisher: Tata McGraw Hill.
2. Production Technology by HMT; Publisher: Tata McGraw Hill.

REFERENCES:

1. Manufacturing Engineering and Technology by Serope Kalpak Jian; Publisher: Pearson Learning.
2. Production Technology by R. K. Jain & S. C. Gupta.
3. Workshop Technology- Vol. 2, by B. S. Raghuvamshi.

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III Year B.Tech ME II Sem	**L**	**T/P/D**	**C**
	4	**1**	**4**

(13MED016) MECHANICAL ENGINEERING DESIGN - II

Course Prerequisites: Mathematics, Mechanics, Strength of Materials, kinematics of machinery and dynamics of Machinery.

Course Objectives:

- Understand different types of bearing and their design, center cranks, crank pins, crank shafts.
- Understand stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and T-section, transmission of power by belt and rope drives, transmission efficiencies.
- Understand the overview of different types of gears and their applications, force analysis, friction in worm gears etc.

Course Outcomes:

Students will be able to:

- Design different types of bearings, clams, cylinder liners, belt and rope drives etc.
- Design crane hooks and C-clamps.
- Design different types of gears like spur gear, helical gear, bevel gear, worm gear etc.

UNIT – I

BEARINGS:

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

UNIT – II

ENGINE PARTS:

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

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 & Overview of Center cranks; Crank pins, Crank shafts.

UNIT – III

DESIGN OF CURVED BEAMS:

Introduction, stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section. Design of crane hooks, C –clamps.

POWER TRANSMISSIONS SYSTEMS, PULLEYS:

Transmission of power by Belt and Rope drives, Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and
rope drives, Materials, Chain drives.

UNIT – VI

SPUR AND HELICAL GEAR DRIVES:

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

UNIT – V

DESIGN OF BEVEL GEAR DRIVES:

Bevel gears – Load concentration factor – Dynamic load factor. Surface compressive strength- Bending strength – Design analysis of Bevel gears- Estimation of centre distance, module and face width, check for plastic deformation, Check for dynamic and wear considerations.

DESIGN OF WORM GEAR DRIVES:

Worm gears – Properties of worm gears – Selection of materials – Strength and wear rating of worm gears – Force analysis – Friction in worm gears – thermal considerations.

TEXT BOOKS:

1. Machine Design by V. Bhandari; Publisher: Tata McGraw Hill.
2. Machine Design by R. L. Norton

REFERENCES:

1. Mechanics of Materials (SI Units) by Beer & Johnson; Publisher: McGraw Hill.
2. Data Books: P.S.G. College of Technology
3. Mechanical Engineering Design by J. E. Shigley
4. Machine Design by R. S. Khurmi & J. S. Gupta; Publisher: Sultan Chand.
5. Machine Design (SI Units) by Schaums Outline Series; Publisher: McGraw Hill.

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III Year B.Tech ME II Sem	**L**	**T/P/D**	**C**
	4	**0**	**4**

(13MED017) METROLOGY AND QUALITY CONTROL

Course Prerequisites: Machine Drawing, Production Technology, machine tools, Probability & Statistics.

Course Objectives:

- Understand limits and fits as applicable in mechanical engineering design.
- Understand the measuring instruments and their operating principles and use
- Understand quality control and statistical quality control.

Course Outcomes:

Students will be able to:

- Apply limits and fits while designing components.
- Use measuring instruments for measuring dimensions and geometry.
- Apply statistical quality control techniques to products.

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 – interchangeability and selective assembly, Indian standard Institution system – knowledge about international standards - ISO 9000, 7QC Tools, British standard system.

UNIT II

LINEAR MEASUREMENT : Limit Gauges Taylors principle – Design of go and No go gauges, plug ring, snap, gap, taper, profile position gauges and slip gauges,.

ANGULAR MEASUREMENT: sine bar, spirit level, angle slip gages and sine plate.

OPTICAL MEASURING INSTRUMENTS:

Tool maker's microscope and its uses – collimators, optical projector.

SURFACE ROUGHNESS MEASUREMENT:

Differences between surface roughness and surface waviness-Numerical assessment of surface finish – CLA,R, R.M.S Values – Rz values, Rz value, Methods of measurement of surface finish-profilograph.

UNIT III

SCREW THREAD MEASUREMENT:

Element of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch.

GEAR MEASUREMENT:

Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch pressure angle and tooth thickness.

UNIT IV

QUALITY CONTROL:

Introduction - quality – quality control – significance- defect and defective – theory of probability – basic concepts – probability distributions – simple problems. Binomial, passion and normal distributions-related properties. Tests of hypothesis-type I, Type II errors and proportions.

UNIT V

STATISTICAL QUALITY CONTROL:

Introduction – significance - elements of quality control – process control – control limits – representations – control charts – control charts for variables – X and R charts – control charts for attributes – C and P charts - steps involved in the constructions of control charts – Acceptance sampling – sampling plans – simple problems – applications and limitations of SQC.

TEXT BOOKS:

1. Engineering Metrology by I C Gupta; Publisher: Dhanpat Rai.
2. Engineering Metrology by R.K. Jain; Publisher: Khanna.
3. Total Quality by Armand V. Feigenbaum; Publisher: McGraw Hill.
4. Probability and Statistics for Engineers - Miller I.R. and Freund J.E, 5th Edition, Prentice-Hall, 1995.

REFERENCES:

1. BIS standards on Limits and Fits, Surface Finish, Machine Tool Alignment etc.
2. Fundamentals of Dimensional Metrology by Connie Dotson Publisher: Thomson.
3. Statistical Quality Control by Eugene Grant; Publisher: McGraw Hill.
4. Introduction to Statistical Quality Control by D. C. Montgomery; Publisher: John Wiley Publications.
5. Metrology by Mahajaan.

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III Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
	4	**0**	**4**

(13EIE080) INSTRUMENTATION AND CONTROL SYSTEMS

Course Objectives:

- To provide basic knowledge in transduction principles, sensors and transducer technology and measurement systems.
- To provide better familiarity with the Theoretical and Practical concepts of automation in industries.
- To provide familiarity with different sensors and their application in real time applications
- To provide the knowledge of various measurement methods of industrial parameters like velocity, acceleration, torque, pressure, flow, temperature etc. and control of the same

Course Outcomes:

Student will be able to:

- Able to know instrumentation system used in the industry.
- Able to appreciate the automation with the help of instrumentation.
- Able to understand the experimental applications and selecting appropriate engineering modules.
- Able to develop aptitude for self-learning and modern technical skills beyond the curriculum.

UNIT I

Definition – Basic principles of measurement – Measurement systems, static characteristics.

MEASUREMENT OF DISPLACEMENT:

Theory and construction of various transducers to measure displacement-Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers.

MEASUREMENT OF SPEED:

Mechanical Tachometers – Electrical tachometers – Stroboscope, Noncontact type of tachometer.

MEASUREMENT OF ACCELERATION AND VIBRATION:

Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle.

UNIT II

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 III

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.

MEASUREMENT OF LEVEL: Direct method – Indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – Bubler level indicators.

FLOW MEASUREMENT: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

UNIT IV

INTRODUCTION TO CONTROL SYSTEMS:

Introduction - basic components of a control system, control-system applications, open-loop control systems (without feed-back systems), and closed-loop control systems (with feedback systems); Example of open loop and closed loop systems. Feedback and its effects - effect of feedback on overall gain, effect of feedback on stability, and effect of feedback on external disturbance or noise; Classification of systems, nonlinear characteristics of systems.

UNIT V

SYSTEM MODELING:

Transfer function (TF) Block diagram (BD) reduction techniques, Signal flow graph(SFG), BD to TF, TF to BD, TF to SFG, SFG to TF conversions, Mathematical Modeling of systems in translational and rotational motions, Analogy between different types of systems like electrical, mechanical, pneumatic & hydraulic, DC motor transfer function, signal flow graph, Working of Potentiometer, tachometer, servo motors, synchros.

TEXT BOOKS:

1. Measurement Systems: Applications & design by D. S. Kumar.
2. Mechanical Measurements by Beckwith, Marangoni & Linehard; Publisher: Prentice Hall International/Pearson Education.

REFERENCES:

1. Measurement systems: Application and Design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh; Publisher: Tata McGraw Hill.
2. Instrumentation and Control systems by S. Bhaskar; Publisher: Anuradha Agencies.
3. Experimental Methods for Engineers by Holman.
4. Mechanical and Industrial Measurements by R.K. Jain; Publisher: Khanna.
5. Instrumentation & Mechanical Measurements by A.K. Tayal; Publisher: Galgotia
6. Instrumentation, Measurement & Analysis by B. C. Nakra & K. K. Choudhary, Publisher: Tata McGraw Hill.
7. Mechanical Measurements by Sahani.

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III Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
Open Elective I	**3**	**1**	**3**

(13CED037) DISASTER MANAGEMENT

Course Objectives:

- Understand the difference between a hazard and disaster
- Know about various disasters and their impacts
- Understand Different approaches of disaster risk reduction
- Understand Disaster risks in India

Course Outcomes:

Students will be able to:

- Acquire the knowledge disaster Management
- Understand the vulnerability of ecosystem and infrastructure due to a disaster
- Acquire the knowledge of Disaster Management Phases
- Understand the hazard and vulnerability profile of India

UNIT-1

Introduction to disaster Concepts and definitions (Disaster, Hazard, Vulnerability, Resilience, Risks)

UNIT-II

Disasters: Classifications, Causes, Impacts (including social, economic, political, environment, health, psychosocial, etc.)

Differential impacts-in terms of caste, class, gender, age, location, disability Global trends in disasters. Urban disaster, pandemics, complex emergencies, Climate change.

UNIT-III

Approaches to disaster Risk reduction

Disaster cycle-its analysis, phase, Culture of safety, prevention, mitigation and preparedness, community based DRR, Structural measures, roles and responsibilities of community. Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), states, center and other stake-holders.

UNIT-IV

Inter-relationship between Disaster and Development

Factors affecting Vulnerabilities, differential impacts, impact of development projects such as dams, embankments, change in land-use etc. Climate change Adaption. Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT-V

Disaster Risk Management in India

Hazard and vulnerability profile of India

Components of Disaster relief: Water, food, sanitation, shelter, health, waste management

Institutional arrangements (Mitigation, Response and Preparedness, DM Act Policy, Other related polices, plan, programmes and legislation)

Project Work :(Field Work, Case Studies)

The project/fieldwork is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard.

Suggested Reading list:

1. Alexander David, Introduction in 'Confronting Catastrophe', oxford University press, 2000.
2. Andharia J. Vulnerability in disaster Discourse, JTCDM, Tata Institute of Social Sciences working paper no.8, 2008.
3. Blaikie, P, Cannon T, Davis I, Wisner B 1997. At Risk Natural Hazards, Peoples' Vulnerability and Disaster, Rutledge.
4. Coppola P Damon, 2007. Introduction to International Disaster Management.
5. Carter, Nick 1991.Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
6. Cuny,F.1983. Development and Disasters, Oxford University Press.
7. Govt.of India; Disaster Management Act 2005,Government of India, New Delhi.

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III Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
Open Elective I	**3**	**1**	**3**

(13ITD005) JAVA PROGRAMMING

Course Objectives:

On completion, students will be able

- To produce object-oriented solutions to a range of standard programming problems.
- They will be able to articulate and restructure programming objectives in the object- oriented paradigm.
- They will be informed with regard to the fundamental concepts and principles of object-oriented programming
- They will be able to apply these concepts in any programming language.

Course Outcomes (LO):

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

- Design/Develop Program
- Implement Program
- Test Program
- Validate Program

UNIT-I

Fundamentals of Object Oriented programming: Object oriented paradigm - Basic concepts of Object Oriented Programming - Benefits of OOP - Applications of OOP

Java Evolution: Java Features - How Java differs from C and C++ - Java and Internet - Java and World Wide Web - Web Browsers - Hardware and Software Requirements - Java Environment. Overview of Java Language: Simple Java Program - Java Program Structure - Java Tokens- Java Statements - Implementing a Java Program - Java Virtual Machine - Constants - Variables - Data types - Scope of Variables-Symbolic Constants-Type Casting and type promotions – Operators, Operator Precedence and Associativity - Control Statements – break - continue- Arrays-Multi dimensional arrays, Wrapper Classes - Simple examples.

UNIT-II

Classes: Classes and Objects - Constructors – methods - this keyword – garbage collection- finalize - Overloading methods and constructors - Access Control- Static members – nested and inner classes – command line arguments - variable length arguments.

Inheritance: Forms of inheritance – specialization, specification, construction, extension, limitation, combination, benefits and costs of inheritance. Super uses- final - polymorphism, method overriding - dynamic method dispatch –abstract classes – exploring string class.

UNIT-III

Packages and Interfaces: Defining and accessing a package – understanding CLASSPATH – access protection importing packages – Interfaces - Defining and implementing an interface, Applying interfaces, Variables in interfaces and extended interfaces. Exploring java.lang and java.util packages.

Exception Handling-Fundamentals, usage of try, catch, multiple catch clauses, throw, throws and finally. Java Built in Exceptions and creating own exception subclasses.

UNIT - IV

Multithreaded Programming: Java Thread life cycle model – Thread creation - Thread Exceptions - Thread Priority – Synchronization - Messaging - Runnable Interface - Interthread Communication - Deadlock - Suspending, Resuming and stopping threads.

I/O Streams: File – Streams – Advantages - The stream classes – Byte streams – Character streams.

Networks basics: Socket Programming - Proxy Servers - TCP/IP Sockets - Net Address - URL - Datagram's

UNIT – V

Applet Programming: How Applets differ from Applications - Applet Life Cycle - Creating an Applet - Running the Applet- Designing a Webpage - Applet Tag - Adding Applet to HTML file - More about Applet Tag - Passing parameters to Applets - Aligning the display.

Event handling: basics of event handling, Event classes, Event Listeners, delegation event model, handling mouse and keyboard events, adapter classes, AWT Class hierarchy - AWT Controls - Layout Managers and Menus, limitations of AWT, Swing, MVC architecture, components, containers, exploring swing.

TEXT BOOKS:

1. The Complete Reference Java J2SE 5th Edition, Herbert Schildt, TMH Publishing Company Ltd, New Delhi.
2. Big Java 2nd Edition, Cay Horstmann, John Wiley and Sons.

REFERENCE BOOKS:

1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI.
2. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.
3. Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.

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III Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
Open Elective I	**3**	**1**	**3**

(13AED010) MODERN AUTOMOBILE TECHNOLOGIES

Course Prerequisites: Physics, Basic Electrical Engineering.

Course objectives:

- Understand the basics of Automobile Engineering without any previous knowledge regarding Automobiles.
- Understand the difference between IC engine Vehicle and HEV/EV.
- Appreciate the current technologies in the Automobile industry

Course outcomes:

Student should be able to

- Apply fundamental knowledge of Automobile Engineering for design of Safety systems like AIRBAGS,ABS etc.,.
- Apply fundamental knowledge of Automobile Engineering for design of Comfort systems like Power steering, Collapsible and tiltable steering column, and power windows. etc.,.
- Gain the knowledge of HEV/EVs and their trouble shooting.

UNIT-I:

INTRODUCTION:

Basic layout of an automobile with reference to power plant, power required for propulsion, various resistances to motion of the automobile, Types of tyres, Basic steering systems, Brakes, Necessity of brake, Two and Three wheelers: Classification of two and three wheelers.

UNIT-II:

ELECTRIC VEHICLES:

Layout of an electric vehicle, performance of electric vehicles – traction motor haracteristics, tractive effort, transmission requirements.

UNIT-III:

HYBRID VEHICLES:

Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, series and parallel hybrid electric drive train design.

UNIT-IV:

SAFETY SYSTEMS:

Airbags, seat belt tightening system, collision warning systems, child lock, anti - lock braking systems, anti - spin regulation, traction control systems.

TELEMATICS:

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition, driver assistance systems.

UNIT-V:

SECURITY SYSTEMS:

Anti theft technologies, smart card system, number plate coding.

COMFORT SYSTEMS:

Active suspension systems, requirement and characteristics, different types, power steering, collapsible and tiltable steering column, power windows.

TEXT BOOKS:

1. "Modern Electric, Hybrid Electric and Fuel Cell Vehicles Fundamentals, Theory and Design", Mehrdad Ehsani, Yimin Gao, sebastien E. Gay and Ali Emadi: CRS Press, 2004.

REFERENCES:

1. "Automotive Hand Book" Robert Bosch, SAE, 5th edition, 2000.
2. "Intelligent Vehicle Technologies", Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann publications, Oxford, 2001.
3. "Navigation and Intelligent Transportation Systems – Progress in Technology", Ronald K Jurgen, Automotive Electronics Series, SAE, USA, 1998.

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III Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
Open Elective I	**3**	**1**	**3**

(13MED020) NON CONVENTIONAL ENERGY SOURCE

Course Prerequisites: Thermodynamics, Fluid Mechanics and Heat Transfer

Course Objectives:

- Understand about different types of Non Conventional Energy Sources.
- Understand about different equipments used in generation of energy.
- Understand about design and fabrication of equipments for collection and conversion of energy.

Course Outcomes:

Students will be able to:

- Select any Non Conventional Energy Source equipment and apply concept of heat transfer and obtain the results.
- Able to design a wind mill.
- Able to design a solar collector for different applications

UNIT – I

INTRODUCTION:

PRINCIPLES OF RENEWABLE ENERGY :

Introduction; Energy and sustainable development; Fundamentals; Scientific principles of renewable energy; Technical implications; Social implications.

PRINCIPLES OF SOLAR RADIATION : 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 technique, solar distillation and drying, photovoltaic energy conversion.

UNIT-III

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

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.

OCEAN ENERGY : OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT-V

DIRECT ENERGY CONVERSION : Need for DEC, Carnot cycle, limitations, principles of DEC.Thermo-electric generators, seebeck, peltier and joul Thomson effects, Figure of merit, materials, applications,MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHDEngine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells,principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:

1. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
2. Non-Conventional Energy Sources /G.D. Rai.

REFERENCES:

1. Renewable Energy Sources /Twidell & Weir.
2. Solar Energy /Sukhame
3. Splar Power Engineering / B.S Magal Frank Kreith & J.F Kreith.
4. Principles of Solar Energy / Frank Krieth & John F Kreider.
5. Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
6. Non-Conventional Energy Systems / K Mittal /Wheeler
7. Renewable Energy Technologies /Ramesh & Kumar /Narosa

VNR Vignana Jyothi Institute of Engineering & Technology

III Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
Open Elective I	**3**	**1**	**3**

(13CSE016) INTELLECTUAL PROPERTY RIGHTS

Course Objectives: This course is designed

- To make students familiar with Intellectual Property Rights.
- To understand innovations in engineering and other domains.
- To be familiar with patents, copyrights and various acts related to innovations.

Course Outcomes:

Students will be able to:

- To define various terms related to Intellectual Property Rights.
- To understand the process of patent, copyrights and related procedures.
- To analyse the situation of IPR in the Indian context with that of global scenario.
- To understand the patenting process through various case studies.

UNIT I

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property i. Movable Property ii. Immovable Property and iii. Intellectual Property.

UNIT II

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures..

UNIT III

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TEXT BOOKS

1. Subbaram N.R. “Handbook of Indian Patent Law and Practice, “ S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.

REFERENCES

1. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
2. Prabhuddha Ganguli: ‘ Intellectual Property Rights” Tata Mc-Graw –Hill, New Delhi.
3. M.Ashok Kumar and Mohd.Iqbal Ali: “Intellectual Property Right” Serials Pub.

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III Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13MED111) MACHINE TOOLS AND METROLOGY LAB

Course Prerequisite: Machine tools and Engineering Materials

Course Objectives:

- Understand the working principles of various machine tools and accessories
- Understand the significance of operating parameters and selection of cutting tools for machining
- Understand working principles of various instruments and their applications
- Understand the significance of calibration and conducting various tests

Course Outcomes:

Students will be able to:

- Select an appropriate machine tool for machining a given material and adopt the knowledge on operating parameters
- Decide the tolerances achieved in different machining operations
- Select appropriate work holding devices
- Select an appropriate instrument for measuring a given parameter

MACHINE TOOLS: Any Six experiments

1. Introduction of general purpose machines - Lathe, Drilling machine, Milling machine, Shaper, Planing machine, slotting machine, Cylindrical Grinder, Surface grinder and Tool and cutter grinder.
2. Exercise on Facing, turning, step turning and taper turning on lathe machine.
3. Exercise on Grooving, Thread cutting and knurling on lathe machine.
4. Exercise on Drilling, Boring, Counter boring, Counter sinking and Tapping operations on drilling machine.
5. Exercise on Shaping to prepare plain surfaces.
6. Exercise on Slotting to prepare contour surfaces.
7. Exercise on Milling to perform plain /gear cutting.
8. Exercise on Cylindrical Grinding machine.
9. Exercise on Grinding of Tool angles.
10. Exercise on Surface Grinding machine.

Demonstration on

Different methods of Taper Turning, Boring, Collar turning, use of four jaw chuck on lathe, Cutting of V - block on shape, Key way cutting on shaper/milling

METROLOGY: Any Six experiments

1. Measurement of various parameters of a given job using Vernier calipers and micrometer.
2. Measurement of internal dimensions with internal micrometer and dial bore indicator.
3. Checking of chordal width and height of a spur gear tooth using gear tooth Vernier calipers.
4. Machine tool alignment test on a lathe.
5. Machine tool alignment test on a milling machine.
6. Measurement of various elements of a screw thread using Tool maker's microscope.
7. Angle and taper measurements by bevel protractor, sine bar etc.
8. Measurement of effective diameter of a screw thread by two wire/ three wire method using floating carriage micrometer.
9. Surface roughness measurement by TalySurf.
10. Measurement of single point cutting tool angles by using profile projector.

REFERENCES:

1. Workshop Technology by W.A.J. Chapman (Parts I, II, and III); Publisher: Viva Books.
2. The Principles of Metallographic Laboratory Practice by George L. Kehl; Publisher: McGraw Hill.

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III Year B.Tech (Common to all Branches)	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13ENG102) ADVANCED ENGLISH COMMUNICATION SKILLS LABORATORY

Introduction

This course aims to offer students a practical approach to Technical Writing, and provide a relevant, contemporary and authoritative introduction to the dynamic field of technical communication that prepares them for Workplace Communication. Each unit in the syllabus is devised so as to include a writing component as well as an oral component.

Course objectives:

- enable the students to create clear, accurate, and succinct content to write business letters, resume, SOP, Proposals and Technical Reports for academics as well as for workplace.
- enable students to adjust technical content to meet the needs of a specific target audience.
- groom students to speak accurately and fluently and prepare them for real world activities through behavioral skills.

Course Outcomes:

Students will be able to:

- summarize and synthesize information and produce technical writing that is required in academics as well as in the engineering profession.
- write covering letters, resume, SOP, Project Proposals and Technical Reports.
- speak fluently and address a large group of audience and participate in debates and discussions.

Methodology

Writing Component

A Process- Genre methodology will be used in teaching the technical genres. This method would enable students to understand the use of particular lexico-grammatical patterns required of in the context of technical writing. They would learn to use language to express the particular communicative intent that is required of in the context of writing these genres.

Syllabus Outline

Unit I

1. Applications and Covering letters
2. Resume Writing
3. Verbal Ability: language, Reading and Listening, Reasoning and Analysis
4. Oral Communication :Talking About Yourself

Unit II

1. Writing an SOP
2. Summarizing and Synthesizing Information (Precis Writing)
3. Oral Communication: Making Presentations

Unit III

1. Writing Project Proposals
2. Oral Communication: Group Discussions

Unit IV

1. Writing Project Reports
2. Oral Communication: Interview Skills

Unit V

Behavioral Skills and Personality Development

1. Building a Positive attitude, Building a Positive Personality, Motivation, Goal Setting & Values & Vision
2. Problem Solving and Decision Making; Negotiation Skills through Role Play
3. Team Building and Leadership Abilities
4. Social Etiquette

REQUIRED TEXT AND MATERIALS

1. Ashraf Rizvi, M (2005). Effective Technical Communication, Tata Mc Graw Hill Publishing Company Limited, New Delhi.
2. Anderson, Paul V. (2003). Reports. In Paul V. Anderson's Technical Communication: A Reader-Centered Approach (5th ed..) (pp. 457-473). Boston: Heinle.
3. William S. Pfeiffer (2012) Technical Communication: A Practical Approach (7th ed.) Longman.

REFERENCES

1. Burnett, Rebecca. Technical Communication. 5th Ed., Heinle, 2001.
2. Gerson Sharon J. and Steven Gerson : Technical Writing Process and Product. 3rd edition, New Jersey: Prentice Hall 1999.
3. Markel, Mike**.** Technical Communication: Situations and Strategies (8th EDITION (2006-2007).
4. R. C. Sharma and K. Mohan, Business Correspondence and Report Writing, Third Edition, TMH, 2002. (Indian Edition).
5. M. Raman and S. Sharma, Technical Communication : Principles and Practices, OUP, 2004. (Indian Edition).

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III Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13EIE176) INSTRUMENTATION AND CONTROL SYSTEMS LAB

Course Objectives:

- To make student get hands on experience in active and passive sensors.
- Understand the principles and appreciate the working of controllers, degrees of freedom, control valves.
- Learn systematic engineering method to solve practical process control problems.

Course Outcomes:

Students will be able to:

- Appreciate the use of sensors.
- Suggest the type of sensors required for any operation.
- Design and develop a simple measuring devices.

List of Experiments:

1. Measurement of Load using Strain Gauge bridge
2. Measurement of Temperature using Thermistor, RTD and Thermocouple
3. Measurement of Displacement using LVDT, use of LVDT for Capacitance measurement
4. Measurement of L,C and R using Bridges and comparing them with Q-Meter
5. Characteristics of Opto-Electric Transducers (Photo Transistor, Photo Diode and LDR)
6. Pressure measurement through Bourdon Tube
7. Radiation and optical Pyrometers
8. Flow level control unit.
9. Temperature level control unit.
10. Servo and regulator operation.
11. Realization of control actions: Pneumatic controllers.
12. Hydraulic controllers.

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IV Year B.Tech ME / AE I Sem	**L**	**T/P/D**	**C**
	3	**1**	**3**

(13MED018) FINITE ELEMENT METHOD

Course Prerequisites: Maths, Strength of Materials, Mechancal Vibrations

Course Objectives:

- Understand different concepts of FEM.
- To study the boundary conditions, formulations and other functional approaches of FEM.
- To perform simulations using FEM software.

Course Outcomes:

Students will be able to:

- Apply suitable FEM approach to solve a given problem.
- Formulate the given problem into finite elements and FEM technique to solve required paramters.
- Apply the concept of FEM to solve different field problems.

UNIT I

FUNDAMENTAL CONCEPTS

Introduction; Historical background; Stresses and equilibrium; Boundary conditions; Strain-displacement relations; Stress-strain relations; Temperature effects.

ONE-DIMENSIONAL PROBLEMS

Introduction; Finite element modeling; Co-ordinates and shape functions; The potential energy approach; Rayleigh-Ritz method; Galerkin's method, The Galerkin approach; Assembly of the global stiffness matrix (**K**) and load vector; Properties of **K**; The finite element equations; Treatment of boundary conditions; Quadratic shape functions; Temperature effects.

UNIT II

TRUSSES

Introduction; Plane trusses; Three-dimensional trusses; Assembly of global stiffness matrix for the banded and skyline solutions.

TWO-DIMENSIONAL PROBLEMS USING CONSTANT STRAIN TRIANGLES

Introduction; Finite element modeling; Constant strain triangle (CST); Problem modeling and boundary conditions.

UNIT III

TWO-DIMENSIONAL ISOPARAMETRIC ELEMENTS AND NUMERICAL INTEGRATION

Introduction; The four-node quadrilateral; Numerical integration; Higher-order-elements.

DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD

Introduction; Vibration problems; Equations of motion based on weak form; Longitudinal vibrations of bars; consistent mass matrices; element equations; solution of Eigen value problems.

UNIT IV

AXISYMMETRIC SOLIDS SUBJECTED TO AXISYMMETRIC LOADING

Introduction; Axisymmetric formulation; Finite element modeling - triangular element; Problem modeling and boundary conditions.

STEADY STATE HEAT TRANSFER ANALYSIS:

One dimensional analysis of Slab, fin and two dimensional analysis of thin plate.

UNIT V

BEAMS

Introduction; Finite element formulation; Hermite shape function, Load vector; Boundary considerations; Shear force and bending moment; Beams on elastic supports;

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering, 2E, by Tirupathi R. Chandrupatla, Ashok D. Belegundu; Publisher: Prentice Hall of India.
2. Text book of Finite Element Analysis by Seshu.
3. Finite Element Analysis using ANSYS 11.0 by Srinivas et all.

REFERENCES:

1. Finite Element Method by Zienkiewicz.
2. An Introduction to Finite Element Methods by J. N. Reddy.
3. Finite Element Method by S. S. Rao.

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IV Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
	4	**0**	**4**

(13MED019) CAD/CAM

Course Prerequisites: Engineering Graphics, Engineering Design, Production technology

Course Objectives:

- Understand the mathematics behind the transformations and projections in design of products on CAD devices.
- Learn the fundamentals of part programming required for manufacturing a product.
- Appreciate the integration of design and manufacturing functions through CAD and CAM.

Course Outcomes:

Students will be able to:

- Identify the types of computer devices and solve the problems on transformations and use them in a CAD software .
- Prepare part programs involving various operations for the manufacturing of simple and complex products.
- Apply the knowledge learnt in integrating CAD and CAM.

UNIT I

INTRODUCTION

Computers in Industrial Manufacturing, Product cycle, CAD and CAM, Overview of CAD / CAM Hardware, Display devices, Hard copy devices.

COMPUTER GRAPHICS

Raster scan graphics, Coordinate systems, Database structure for graphics modeling, Transformation of geometry, 3D Transformations, Mathematics of projections, Clipping, Hidden surface removal.

UNIT II

GEOMETRIC MODELING

Geometric models, Geometric construction methods, Curve representation, Surface representation methods, Modeling facilities desired, Solid modeling.

DRAFTING SYSTEMS

Basic geometric commands, Layers, Display control commands, Editing, Dimensioning.

UNIT III

COMPUTER NUMERICAL CONTROL

Introduction to NC machines and CNC machines, Structure of CNC machine tools, Features of Machining center, Concept of ATC & APC, Feedback control.

CNC PART PROGRAMMING

Fundamentals, Introduction to G & M codes, Manual part programming methods, Computer Aided Part Programming.

UNIT IV

GROUP TECHNOLOGY

Philosophy of Group Technology, Part families, Methods of Parts Classification and Coding, Advantages and Limitations.

COMPUTER AIDED PROCESS PLANNING

Introduction, Retrieval type and Generative type, Benefits.

UNIT V

COMPUTER AIDED QUALITY CONTROL

Introduction, Terminology in quality control, The computer in QC, Contact inspection methods, Noncontact inspection methods-optical and nonoptical, Computer aided testing, Integration of CAQC with CAD/CAM.

COMPUTER INTEGRATED MANUFACTURING SYSTEMS

Introduction, Types of Manufacturing systems, Machine tools and related equipment, Material handling systems, Computer Control Systems, Human labor in the manufacturing systems, CIMS benefits.

TEXT BOOKS:

1. CAD / CAM by A. Zimmers and P. Groover; Publisher: Prentice Hall International/Pearson Education.
2. CAD/CAM Principles and Applications by P N Rao; Publisher: Tata McGraw Hill
3. CAD / CAM Theory and Practice by Ibrahim Zeid; Publisher: Tata McGraw Hill

REFERENCES:

1. Automation, Production Systems and Computer integrated Manufacturing by Groover; Publisher: Pearson Education.
2. CAD / CAM / CIM by Radhakrishnan and Subramanian; Publisher: Pearson Education
3. Principles of Computer Aided Design and Manufacturing by Farid Amirouche; Publisher: Pearson Education
4. CAD/CAM: Concepts and Applications by Alavala; Publisher: Prentice Hall International
5. Computer Numerical Control Concepts and programming by Warren S Seames; Publisher: Thomson

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IV Year B.Tech ME I Sem	**L**	**T/P/D**	**C**
	3	**1**	**3**

(13AED076) AUTOMOBILE ENGINEERING

Course Prerequisites: Thermodynamics, Basic Electrical Engineering.

Course objectives:

- Understand the Working of Fuel, Ignition, and cooling Systems
- Understand the Working of Lubrication and Electrical Systems.
- Understand the Working of transmission, Suspension, Steering and Braking Systems.

Course outcomes:

Student should be able to:

- Diagnose the simple problems on Fuel, Ignition, Cooling, Lubrication and electrical systems.
- Diagnose the simple problems on transmission, Suspension, Steering and Braking Systems
- Develop safe attitude towards mechanical operations of the Automotive systems.

UNIT – I

INTRODUCTION: Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, turbo charging and super charging –

ENGINE LUBRICATION: Splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft.

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

UNIT – II

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

C. I. ENGINES: Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps.

EMISSION FROM AUTOMOBILES AND ALTERNATE FUELS: Pollution standards, National and international, Pollution Controll, Techniques, Multipoint fuel injection for SI Engines, Common rail diesel injection Energy alternatives, Photo-voltaic, hydrogen, LPG, CNG, hybrid and electrical vehicles their merits and demerits.

UNIT – III

ELECTRICAL SYSTEM: Lead acid battery, generator, current – voltage regulator, starting system, Bendix drive mechanism, solenoid switch, lighting systems, Horn, wiper, fuel gauge, oil pressure gauge, engine temperature indicator etc.

IGNITION SYSTEM: Function of an ignition system, battery ignition system, 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.

UNIT – IV

TRANSMISSION SYSTEM: Clutches, principle, types, single plate clutch, multi plate clutch, 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, air suspension system, MacPherson Strut suspension system.

UNIT-V

STEERING SYSTEM: Steering geometry – camber, castor, 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 under steering and over steering, Power steering.

BRAKING SYSTEM: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder, tandem master cylinder, Requirement of brake fluid, Pneumatic and Vacuum brakes, ABS (Anti Lock Breaking System).

TEXT BOOKS:

1. Automotive Mechanics by Heitner.
2. Automotive Mechanics by William Crouse.

REFERENCES:

1. A Text Book of Automobile Engineering by Manzoor, Nawazish Mehdi & Yosuf Ali; Publisher: Frontline Publications.
2. Automotive Engineering by Newton; Publisher: Steeds & Garrett.
3. Automotive Mechanics by G. B. S. Narang.
4. Automotive Engines by Srinivasan.
5. Automobile Engineering by K. K. Ramalingam; Publisher: Scitech.
6. Automobile Engineering Vol. 1 & Vol. 2 by Kripal Singh.

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IV Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
Elective II	**3**	**1**	**3**

(13MED021) AUTOMATION & ROBOTICS

Course Prerequisites: Production technology, control power systems, mathematics, kinematics of machinery.

Course Objectives:

- To learn concepts of automation and robotics and components, end effectors of robots.
- To study the motion analysis, kinematics, dynamics, types of robot motions and the various actuators and feedback components used in robots.
- To learn the basics of robot programming, its languages and the industrial applications of robots.

Course Outcomes:

Students will be able to:

- Identify the different robot configurations and find out the positions, angles of the manipulators given the required using the motion analysis, kinematics, dynamics and trajectory planning concepts.
- Analyze the different types of feedback components and sensors used in robots.
- Able to program a robot using the programming and languages.

UNIT I

INTRODUCTION

Basic principles of automation, Hard Automation, Flexible Automation, basic elements of automated system, levels of automation. Automation & Robotics, An overview of Robotics, Classification by Coordinate Systems 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.

Motion Analysis: Basic rotation matrices, Composite rotation matrices, Euler angles, Equivalent angle and axis, Homogeneous transformation, Problems.

UNIT II

KINEMATICS AND DYNAMICS

Manipulator Kinematics: D-H notations, Joint coordinates and world coordinates, Forward and Inverse kinematics, Problems.

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 III

TRAJECTORY PLANNING

Joint space scheme, Cubic polynomial fit, Avoidance of obstacles, Types of motions: Slew motion, Joint interpolated motion, Straight line motion, Problems.

UNIT IV

ROBOT ACTUATORS AND FEEDBACK COMPONENTS

Actuators – Pneumatic, Hydraulic and Electric actuators, DC Servo motors, Stepper motors.

Feedback components – Position sensors, Potentiometers, Resolvers and Encoders, Velocity sensors, Tactile sensors.

UNIT V

ROBOT PROGRAMMING AND LANGUAGES:

Lead through programming, Motion programming, Motion interpolation, Robot programming language, interlock and sensor commands, Simulation and Off-Line programming.

ROBOT APPLICATIONS IN MANUFACTURING:

Material Handling and transfer, Welding, Assembly, Inspection, Future applications

TEXT BOOKS:

1. Industrial Robotics by M. P. Groover; Publisher: Pearson Education
2. Introduction to Robotic Mechanics and Control, by J. J. Craig, Publisher: Pearson Education

REFERENCES:

1. Robot Dynamics and Control by M.W.Sponge and M.Vidyasagar; Publisher: John Wiley.
2. Robotics by K.S.Fu; Publisher: McGraw Hill.
3. Robotic Engineering by Richard Klafter, Publisher: Prentice Hall.
4. Robot Analysis and Intelligence by Asada & Slotine, Publisher: Wiley Interscience.
5. Robotics & Control by Mittal R. K. & Nagrath I. J., Publisher: Tata McGraw Hill.
6. Modeling and control of robot manipulators by Sialliano & Sciallicco,Springer.

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IV Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
Elective II	**3**	**1**	**3**

(13MED022) COMPOSITE MATERIALS

Course Prerequisites: Maths, Physics, Chemistry and engineering mechanics

Course Objectives:

- Understand composite materials and their properties, relationship between them and manufacturing of different types.
- Understand the principles of material science applied to composite materials.
- Study the equations to analyze problems by making good assumptions and learn systematic engineering method to solve practical composite mechanics problems.

Course Outcomes:

Students will be able to

- Apply fundamental knowledge of mathematics to modeling and analysis of composite materials.
- Able to understand the manufacturing methods of various composite materials.
- Able to analyze the failure of composites.

UNIT I

INTRODUCTION

Introduction to Composite Materials: Introduction, definition of composite materials, Classification of composites: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon-Carbon Composites, Fiber reinforced Composites and Nature made composites, and applications.

UNIT II

REINFORCEMENTS

Introduction, Classification of reinforcements, Flexibility, Fibers: Glass-Fabrication, structure, properties and applications, Boron-Fabrication, structure and morphology, properties and its applications, Carbon preparation, processing, properties and applications, Preparation, properties and applications of: Organic fibers–Polyethylene, Aramid, Ceramic, Non oxide-Silicon carbide, Whiskers.

UNIT III

MATRIX MATERIALS

Introduction, Polymers matrix materials-Thermoplastics and Thermosets, copolymers, molecular weight, degree of crystallinity, stress strain behavior Common thermoset matrix materials- epoxy, polyster, polyimides common thermoplastic matrix materials-polyphenylene sulfide, polyaryl sulfone, Metal matrix materials- structure, properties of metals, common metals applied as matrix metals, Ceramix matrix materials-types, properties.

Interfaces-wettability, effect of surface roughness, crystallographic nature of interface, Types of bonding at the interface-mechanical, physical, Chemical bonding.

Tests for measuring interfacial strength-Flexural tests, three point bending, four point bending, short beam shear test, iosipescu shear test, Single fiber pullout test, curved neck specimen test, instrumented indentation test, fragmentation test., Laser spallation technique.

UNIT IV

MANUFACTURING METHODS

Polymer matrix composites(PMC)-Processing of thermoset matrix composites, Handy Lay –Up and Spray Techniques, Filament winding, pultrusion, resin transfer molding, Tape-Laying and fiber placement systems, Autoclave –based methods, Thermoplastic matrix composites-Film stacking, Diaphraming, Thermoplastic Tape laying, Injection Moulding, sheet moulding compound (SMC)

Types of Metal Matrix composites, processing-liquid state process, solid state process, In situ process, properties and applications.

Ceramic matrix composites(CMC)-processing OF CMC, Cold pressing and sintering, Hot pressing, Reaction bonding process, Liquid infiltration, Lanxide process, In Situ chemical Reactions Techniques-chemical vapour deposition and chemical vapour impregnation, sol-gel and polymer pyrolysis, Properties and applications of CMC, Carbon Fiber composites-processing, properties and its applications.

UNIT V

MICROMECHANICS OF COMPOSITES

Introduction, Density, Volume, and Mass fractions, void contents, Mechanical Properties: Prediction of elastic constants,

Halpin-Tsai Equations, Thermal properties: Thermal expansion coefficients of composites, thermal conductivity of composites, Hygral and Thermal stress.

MACROMECHANICS OF COMPOSITES

Introduction, elastic constants of an isotropic material, elastic constants of a Lamina, Relationships between engineering constants and reduced stiffness and compliances, Fracture modes in composites: single and multiple fracture, debonding, fiber pullout, delamination, fracture, fatigue and creep properties of composites, Design with composites: Advantages of composites in structural design, Fundamental characteristics of composites.

TEXT BOOKS:

1. Composite Materials Science and Engineering by Krishan K. Chawla; Publisher: Springer.
2. Engineering Mechanics of Composite Materials by Isaac and M. Daniel; Publisher: Oxford University Press, 1994.

REFERENCES:

1. Mechanics of Composites Material by R. M. Jones, Publisher: McGraw Hill.
2. Mechanics of Composite materials and Structures by Madhuji Mukhopadyaya Publisher: University Press.
3. Analysis and performance of Fiber Composites by B. D. Agarwal, L. J. Broutman, and K. Chandrasekhara; Publisher: John Wiley.

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IV Year B.Tech ME I Sem	**L**	**T/P/D**	**C**
Elective II	**3**	**1**	**3**

(13MED023) THEORY OF METAL CUTTING

Course Prerequisites: Production technology, Machine tools

Course Objectives:

- Understand the cutting tools geometry and their areas of application based on principle of cutting.
- Understand cutting forces and their measurement.
- Understand tool wear, replacement strategy and optimization of cutting tool usage.

Course Outcomes:

Students will be able to

- Analyze a cutting tool, its geometry and arrive at the cutting process.
- Select a cutting tool material and appropriate to material to be cut.
- Select a cutting tool with optimal tool life to maximize material removal rate.

UNIT I

INTRODUCTION

Mechanics of Metal Cutting: Mechanism of chip formation, Orthogonal and Oblique cutting, Determination of shear plane angle, forces on the chips, forces in orthogonal cutting, merchant circle diagram and analysis, co-efficient of friction, power and energy relationship, velocity relationship, shear-strain relationship, factors affecting forces and power, types of chips, built-up edge, problems.

UNIT II

MEASUREMENT OF CUTTING FORCES

Reasons for measuring cutting forces, Classification of cutting force dynamometers – mechanical, piezoelectric, and strain gage type dynamometers, Dynamometers for lathe, drilling, and milling, Calibration of dynamometers.

TOOL WEAR, TOOL LIFE

Mechanisms of tool wear, Sudden, gradual wear, crater wear, flank wear, tool failure criteria, tool life equations, effect of process parameters on tool life.

UNIT III

GEOMETRY OF CUTTING TOOLS

Single point and multi point cutting tools, tools in hand nomenclature, tool point reference systems, tool angle specifications – ISO and ASA systems, conversion from one system to another. Effect of cutting parameters on tool geometry.

TOOL MATERIALS AND THEIR PROPERTIES

Characteristics of tools materials, types of tool materials – carbon tool steels, high speed steels, cast alloys, cemented carbides, ceramics, diamonds, sialon, CBN, UCON, recommended cutting speeds for the above tools.

UNIT IV

THERMAL ASPECTS IN METAL CUTTING

Heat sources in metal cutting, temperature in chip formation, temperature distribution, experimental determination of tool temperatures.

CUTTING FLUIDS

Basic actions of cutting fluids, properties of cutting fluids, selection of cutting fluids, application of cutting fluids, recommended cutting fluids.

UNIT V

ECONOMICS OF MACHINING

Introduction, elements of total production cost, optimum cutting speed and tool life for minimum cost, optimum cutting speed and tool life for maximum production, problems.

TEXT BOOKS:

1. Principles of Metal Cutting by G. C. Sen and A. Bhattacharya; Publisher: New Central Book Agency.
2. Metal Cutting Principles by M C Shaw; Publisher: Oxford and IBH Publications

REFERENCES:

1. Fundamentals of Machining by Boothroyd; Publisher: Edward Amold
2. Metal Cutting Theory and Cutting Tool Design by V. Arshinov & G. Alekseev; Publisher: Mir Publishers, Moscow
3. Fundamentals of Metal Cutting and Machine tools by B. L. Juneja, G. S. Sekhom & Nitin Seth; Publisher: New Age International
4. Principles of Metal Cutting by G. Kuppuswamy; Publisher: Universities Press

VNR Vignana Jyothi Institute of Engineering and Technology

IV Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
Elective II	**3**	**1**	**3**

(13MED025) SURFACE MODIFICATION TECHNIQUES

Course Prerequisites: Material science, Chemistry, Physics, Mechanical Properties of materials, Physical Metallurgy.

Course Objectives:

- Understand the properties of surfaces and know different methods of protection.
- Understand Surface treatment processes for engineering applications.
- Understand advanced tools and techniques used in the characterization of coatings.

Course Outcomes:

Students will be able to:

- Design surface coating based on surface structure and product requirements.
- Select on appropriate surface modification depending on application requirements.
- Decide on material and surface modification selections appropriate to application environment.

UNIT I

INTRODUCTION TO SURFACE ENGINEERING

Differences between surface and bulk, Properties of surfaces-wear, corrosion, optical, roughness, electrical and thermal properties, wetability. Surface protection (physical), surface modification (chemical) techniques: classification, principles, methods and technology.

UNIT II

CONCEPTS OF COATING

Coatings- Concepts of coatings , Electroplating and electroless plating -Metallic and non metallic coatings- chemical vapour deposition, physical vapour deposition, Galvanizing – Thermal Spray, types of thermal spray and their advantages and disadvantages - conventional verses nanocoatings.

UNIT III

PLASMA COATING TECHNOLOGY

Process parameters, thermal and kinetic history of inflight particle, micro structural features of plasma sprayed coatings, single splat studies, process-structure property relationship challenges in preparation, plasma spraying of nanopowders - its microstructure – properties–Liquid precurser plasma spray- applications.

UNIT IV

CHARACTERIZATION OF COATINGS

Coatings –thickness-porosity-hardness, fracture toughness-elastic modulus –adhesion bending strength-fracture strength- tensile strength- wear and corrosion measurement phase analysis

UNIT V

HARD AND SOFT COATINGS

Laser cladding- laser alloying, Electron beam hardening-ion beam implantation- sol – gel coatings –electrophoretic deposition –DLC and diamond coatings, antifriction and antiscratch coatings.

SPUTTERING TECHNIQUES

Methods, applications, plasma treatments, nitriding–carbonising – boriding, titanizing methods, applications.

TEXT BOOKS:

1. Surface Engineering of Metals, Principles, equipments and Technologies-Tadeusz Burakowski, Padeusg and Weirzxhon, CRC press, 1998.
2. Surface coatings for protection against wear edited by BG Miller, Woodhead publishing – 2006.

REFERENCES:

1. Surface coatings ASM handbook.
2. Characterization Techniques ASM Handbook.
3. P. Fauchais, A. Vardelle, and B. Dussoubs, "Quo Vadis Thermal Spraying? "Journal of Thermal Spray Technology, Volume 10(1) March2001.
4. H. Herman and S. Sampath "Thermal Spray Coatings" Published in 1996 by Chapman and Hall, London. Edited by Kurt H Sien.

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IV Year B.Tech ME I Sem	**L**	**T/P/D**	**C**
Elective II	**3**	**1**	**3**

(13MED026) TOOL DESIGN

Course Prerequisites: Design principles, machine tools, process engineering.

Course Objectives:

- Understand the properties of tool materials such as ferrous, non ferrous, non metallic materials and their heat treatment .
- How to design single and multi point cutting tools for various applications, Must gain the knowledge of designing Jigs and Fixtures.
- Understand design of sheet metal tools for blanking, piercing, bending, forming and drawing etc.

Course Outcomes:

Students should be able to:

- Design single and multi point cutting tools for various methods.
- Appropriate design for jigs and fixtures for several components depending on quantity requirement.
- Decode an appropriate heat treatment for the tools.

UNIT I

TOOL MATERIALS AND HEAT TREATMENT

Introduction, Properties of Materials, Ferrous Tooling Materials: Tool Steels, Cast Iron and Mild or Low Carbon Steels; Non Metallic Tooling Materials, Non ferrous Tooling Materials, Heat Treating, Appearance of Carbon in Steel, Factor Affecting Heat Treating, Heat Treatment and Tool Design.

UNIT - II

DESIGN OF CUTTING TOOLS

Introduction, A Brief History of Metal Cutting, The Metal Cutting Process: The Basic Requirements of a Cutting Tool, Mechanism and Geometry of Chip Formation, General Consideration for Metal Cutting, Metal Cutting Tools: Single Point Cutting Tools, Milling Cutters, Drills and Drilling, Types of Drills, Reamers, Reamer Classification, Taps, Taps Classification; The Selection Of Carbide Cutting Tools: Carbide Tools Determination of Shank Size for Single Point Carbide Tools, determining the Insert thickness for Carbide Tools

UNIT - III

DESIGN OF DRILL JIGS AND FIXTURES

Introduction, Definition of a Drill Jig, Types of Drill Jigs, Chip Formation in Drilling, General Considerations in the Design of Drill Jigs, Drill Bushing, Methods of Construction, Drill Jigs and Modern Manufacturing,. Fixtures and Economics, Types of Fixtures: Vice Fixtures, Milling Fixtures, Boring Fixtures, Broaching Fixtures, Lathe Fixtures, Grinding Fixtures;

UNIT -IV

DESIGN OF SHEET METAL BLANKING AND PIERCING DIES

Introduction, Introduction to Die Cutting Operations: The Fundamentals of Die Cutting Operations, Power Press Types, General Press Information, Materials Handling Equipment. Cutting action in Punch and Die Operations. Die Clearance, Types of Die Construction; Die Design Fundamentals: Blanking and Piercing Die Construction, Pilots, Stripper and Pressure Pads, Presswork Material, Strip Layout, Short-Run Tooling for Piercing.

UNIT- V

DESIGN OF SHEET METAL BENDING, FORMING AND DRAWING DIES

Introduction, Bending Dies, Drawing Dies, Forming Dies, Drawing Operations, Variables that affect metal flow during Drawing. Determining Blank Size, Drawing Force, Single and Double - action draw dies.

TEXT BOOK:

1. Tool Design by Cyril Donaldson, George H LeCain & V C Goold; Publisher: Tata McGraw Hill.

REFERENCES:

1. Fundamentals of Tool Design by David Splitler, Jelf Lantrip & D. A. Smith; Publisher: Society of Manufacturing Engineers.
2. Production Engineering by P.C. Sharma; Publisher: Sultan Chand.

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IV Year B.Tech ME I Sem	**L**	**T/P/D**	**C**
Elective III	**3**	**1**	**3**

(13MED027) MECHANICAL VIBRATIONS

Course Prerequisites: Design of Machine Members, Engineering Mechanics, Maths

Course Objectives:

- Understand and appreciate the importance of vibrations in mechanical design of machine parts that operate in vibratory conditions.
- Develop linear vibratory models of dynamic systems with changing complexities (SDOF, MDOF).
- Formulate the differential equations of motion of vibratory systems.

Course Outcomes:

Students will be able to:

- Do vibration analysis in mechanical design of machine parts that operate in vibratory conditions.
- Arrive at linear mathematical models of real life engineering systems.
- Analyze the mathematical model of linear vibratory system to determine its response.

UNIT I

INTRODUCTION

Introduction to vibrations & basic concepts

SINGLE DEGREE OF FREEDOM SYSTEMS – I

Undamped and damped free vibrations, Forced vibrations, Coulomb damping, Response to excitation, Rotating unbalance and support excitation, Vibration isolation and transmissibility.

UNIT II

SINGLE DEGREE OF FREEDOM SYSTEMS – II

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 III

VIBRATION MEASURING INSTRUMENTS

Vibrometers, Velocity meters & Accelerometers.

NUMERICAL METHODS

Rayleigh Stodola matrix iteration, Rayleigh Ritz method and Holzer method.

UNIT IV

TWO DEGREE FREEDOM SYSTEMS

Principal modes, Undamped and damped free and forced vibrations, Undamped vibration absorbers.

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.

UNIT V

CONTINUOUS SYSTEM

Free vibration of strings, Longitudinal oscillations of bars, Traverse vibrations of beams, Torsional vibration of shafts.

CRITICAL SPEEDS OF SHAFTS

Critical speeds without and with damping, secondary critical speed.

TEXT BOOKS:

1. Fundamentals of Vibrations by Leonard Meirovitch; Publisher: McGraw Hill
2. Mechanical Vibrations by Groower G. K
3. Mechanical Vibrations by Rao V Dukkipati & J. Srinivas, Publisher: Prentice Hall

REFERENCES:

1. Mechanical Vibrations by Tse, Morse and Hinkle
2. Vibration problems in Engineering by S. P. Timoshenko
3. Mechanical Vibrations by S.Graham Kelly; Publisher: Schaum's Outline, TMH
4. Mechanical Vibrations by Rao S. S., Publisher: Pearson
5. Mechanical Vibrations by V. Ram Murthy
6. Mechanical Vibrations SETO Schaumm Series, Mc Graw Hil Publications.

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IV Year–B.Tech ME I Sem	**L**	**T/P/D**	**C**
	3	**1**	**3**

(13MTH006) PROBABILITY AND STOCHASTIC PROCESS

Course prerequisites: permutations and combinations, basic statistics

Course Objectives:

- Understand the elementary ideas in basic probability.
- Understand the different types of probability distribution functions
- Understand the basic concepts in estimation theory and test of hypothesis
- Understand the basic concepts of reliability.

Course Outcomes:

Students will be able to

- Solve problems involving basic probability.
- Apply the knowledge of different probability distributions to Test of Hypothesis.
- Calculate correlation, regression coefficients.
- Apply the knowledge of different probability distributions to solve problems reliability.

UNIT- I

Probability and Distributions

Sample space and events, Probability- The axioms of probability, some elementary theorems, conditional probability, Baye's theorem. Random variables - discrete and continuous. Distributions - Binomial, Poisson and Normal distributions–related properties.

UNIT -II

Correlation and Regression

Coefficient of correlation, regression coefficient, the lines of regression, rank correlation

UNIT- III

Sampling Distributions and Testing of Hypothesis

Sampling distributions, sampling distribution of means (σ known and unknown). Point estimation, interval estimation. Tests of hypothesis - null hypothesis, alternate hypothesis, type I, type II errors, critical region. Inferences concerning means and proportions- Large samples- test of hypothesis for single mean and difference between the means. Test of hypothesis for the proportions- single and difference between the proportions, confidence interval for the mean and proportions.

UNIT -IV

Tests of significance- Small samples

Tests of significance-t distributions, confidence interval for the t- distribution, F-distributions and Chi square distributions.

UNIT -V:

Stochastic process: **Reliability**

Basic concepts of reliability, Normal failure law, Exponential failure law, The Weibull failure law and reliability of systems.

TEXT BOOKS

1. Probability and Statistics for Engineers – Richard . A.Johanson, 1995, 5th Edition, Prentice-Hall.
2. Introductory Probability and Statistical Application - Meyer,(1970), 2nd edition, Oxford and Ibh.

REFERENCES

1. Applied Statistics for Engineers-Jay.L.Devore, Nicholas. R.Famum, Jimmy.A.Doi, 3rd Edition, Cengage.
2. Practical Reliability Engineering-Patrick o'Connor-Wiley Publications(2002).
3. Reliability in Automotive and Mechanical Engineering –Springer –Verlag(2008).

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IV Year B.Tech ME I Sem	**L**	**T/P/D**	**C**
Elective III	**3**	**1**	**3**

(13MED028) ADVANCED SOLID MECHANICS

Course Prerequisite: Mechanics of solids basics, Engineering Mechanics, Mathematics.

Course Objectives:

- Understand the concept of stress and strain in 3-D, cauchy's formula, Mohr's circle, Drucker-pager yield criteria, shear effect on inelastic bending etc.
- Understand the concept of torsion, buckling and stability, columns with eccentric axis loads.
- Understand method of superposition, principal of work, power and energy and its importance.

Course Outcomes:

Students will be able to:

- Solve solid mechanics problems effectively using software's.
- Understand the concept of torsion, buckling and stability, columns with eccentric axis loads.
- Analyze stresses build in various members in a given applications.

UNIT I

THREE DIMENSIONAL STRESSES

Introduction, Stress and Strains in 3-D – Cauchy's formula, Principal Stress, hydrostatic stress, deviatoric stress, stress transformations, Mohr circle, octahedral shear stress, strain energy densities, etc.

THEORIES OF FAILURE

Yield criteria: general concepts – maximum principal stress criterion, maximum principal strain criterion, and strain-energy density criterion; Yielding of ductile metals – maximum shear stress (Tresca) criterion, distortional energy density (von mises) criterion, and effect of hydrostatic stress and the π - plane; alternative yield criteria – mohr-coulomb yield criterion, Drucker-Prager yield criterion, and Hill's criterion for orthotropic materials; General yielding – elastic-plastic bending, fully plastic moment, shear effect on inelastic bending, modulus of rupture, comparison of failure criteria and interpretation of failure criteria for general yielding.

UNIT II

UNSYMMETRICAL BENDING

Introduction; Doubly symmetric beams with skew loads; Pure bending of unsymmetric beams; Generalized theory of pure bending; Bending of beams by lateral loads; Shear centre; Shear stresses in beams of thin-walled open cross sections; Shear centers of

thin walled open sections; General theory for shear stresses.

BENDING OF CURVED BEAMS

Introduction; Circumferential stresses in a curved beam – location of neutral axis of cross section; Radial stresses in curved beams – curved beams made from anisotropic materials; Correction of circumferential stresses in curved beams having I, T, or similar cross sections – Bleich's correction factors; Deflections of curved beams – cross sections in the form of an I, T, etc.; Statically indeterminate curved beams – fully plastic versus maximum elastic loads for curved beams.

UNIT III

TORSION

Torsion of Non-circular members, hollow members, thin walled sections; Membrane Analogy.

COLUMNS

Buckling and stability; Columns with pinned ends; Columns with other support conditions; Columns with eccentric axis loads; Secant formula; Imperfections in columns; Elastic and inelastic column behavior; Inelastic buckling; Column design formulas.

UNIT IV

BEAM ON ELASTIC FOUNDATIONS

General theory; Infinite beam subjected to concentrated load: boundary conditions – method of superposition, and beam supported on equally spaced discrete elastic supports; Infinite beam subjected to a distributed load segment – uniformly distributed load; semi infinite beam subjected to loads at its end; semi infinite beam with concentrated load near its end; Short beams.

UNIT V

ENERGY METHODS

Introduction; Principal of virtual work; Unit-load method for calculating displacements; Reciprocal theorems; Strain-energy and complementary energy; Strain-energy methods; Complementary energy methods; Castigliano's second theorem; Shear deflections of beams. Introduction to Photoelasticity.

TEXT BOOKS:

1. Advanced Mechanics of Materials (6E) by Arthur P. Boresi and Richard J. Schmidt; Publisher: John Wiley.
2. Mechanics of Materials by J. M. Gere and S. Timoshenko; Publisher: CBS.

REFERENCES:

1. Strength of Materials (part 2): Advanced Theory and Problems by Stephen Timoshenko; Publisher: CBS.
2. Engineering Mechanics of Solids by E.P.Popov; Publisher: Pearson Education.
3. Strength of Materials Schaum's Series.

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IV Year B.Tech ME I SEM	**L**	**T/P/D**	**C**
Elective III	**3**	**1**	**3**

(13MED030) REFRIGERATION AND AIR CONDITIONING

Course Prerequisites: Thermodynamics, Heat & Mass Transfer.

Course Objectives:

- Understand the fundamentals of Thermodynamics and its relative laws and effect on the system.
- Understand the concept of Heat and Mass Transfer on the system.
- Understand the various Thermodynamic cycles used in the Refrigeration and AC systems

Course Outcomes:

Students will be able to:

- Develop a system which totally based on the refrigeration concept.
- Apply the basic principles on the Thermodynamics to solve an engineering problem related to Refrigeration and Air conditioning.
- Select suitable Refrigeration cycle and apply the concept of Heat and Mass Transfer and obtain the result.

UNIT – I

Introduction to Refrigeration: Necessity and applications – Unit of refrigeration and C.O.P. – Mechanical Refrigeration – Types of Ideal cycles of refrigeration. Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system problems – Refrigeration needs of Air crafts. Refrigerants – Desirable properties – classification refrigerants used – Nomenclature – Ozone Depletion– Global Warming .

UNIT – II

Vapour compression refrigeration – working principle and essential components of the plant – simple Vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – numerical Problems.

System Components : Compressors – General classification – comparison – Advantages and Disadvantages. Condensers – classification – Working Principles Evaporators – classification – Working Principles Expansion devices – Types – Working Principles.

UNIT III

Vapor Absorption System – Calculation of max COP – description and working of NH3 – water system and Li Br –water (Two shell & Four shell) System. Principle of operation Three Fluid absorption system, salient features.

Steam Jet Refrigeration System – Working Principle and Basic Components. Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

UNIT – IV

Introduction to Air Conditioning: Psychometric Properties & Processes – Characterization of Sensible and latent heat loads — Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, GSHF- Problems, Concept of ESHF and ADP.

Requirements of human comfort and concept of effective temperature- Comfort chart –Comfort Air conditioning – Requirements of Industrial air conditioning , Air conditioning Load Calculations.

UNIT – V

Air Conditioning systems - Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers. Heat Pump – Heat sources – different heat pump circuits.

TEXT BOOKS :

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

REFERENCES:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age.
2. Principles of Refrigeration - Dossat / Pearson Education.
3. Refrigeration and Air Conditioning-P.L.Bellaney.
4. Basic Refrigeration and Air-Conditioning – Ananthanarayanan / TMH.
5. Refrigeration and Air Conditioning – R.S. Khurmi & J.K Gupta – S.Chand – Eurasia Publishing.

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IV Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
Elective III	**3**	**1**	**3**

(13MED031) INTRODUCTION TO AIRCRAFT INDUSTRY AND AIRCRAFT SYSTEMS

Course Prerequisites: Engineering Mechanics, Machine Design, Fluid Mechanics, Basic Electricals and Electronics.

Course Objectives:

- Understand the Aircraft industry and basic components of Aircrafts.
- Understand basic electrical, mechanical and electronic equipments of Aircraft.
- Understand principles of flight and flight mechanics, performance and maneuvers.

Course Outcomes: Students will be able to

- Analyze various Aircraft systems.
- Analyze the flow characteristics and forces on air craft structures.
- Analyze the flight characteristics, stability of Aircrafts.

UNIT- I

AIRCRAFT INDUSTRY OVERVIEW

Evolution and History of Flight, Types Of Aerospace Industry, Key Players in Aerospace Industry, Aerospace Manufacturing, Industry Supply Chain, Prime contractors, Tier 1 Suppliers, Key challenges in Industry Supply Chain, OEM Supply Chain Strategies, Mergers and Acquisitions, Aerospace Industry Trends, Advances in Engineering/CAD/CAM/CAE Tools and Materials technology, Global and Indian Aircraft Scenario.

UNIT- II

INTRODUCTION TO AIRCRAFTS

Basic components of an Aircraft, Structural members, Aircraft Axis System, Aircraft Motions, Control surfaces and High lift Devices. Types of Aircrafts - Lighter than Air/Heavier than Air Aircrafts Conventional Design Configurations based on Power Plant Location, Wing vertical location, intake location, Tail Unit Arrangements, Landing Gear Arrangements. Unconventional Configurations-Biplane, Variable Sweep, Canard Layout, Twin Boom Layouts, Span loaders, Blended Body Wing Layout, STOL and STOVL Aircraft, Stealth Aircraft, Advantages and disadvantages of these Configurations.

UNIT- III

INTRODUCTION TO AIRCRAFT SYSTEM

Types of Aircraft systems, Mechanical systems. Electrical and Electronic Systems. Auxiliary systems. Mechanical Systems: Environmental control systems (ECS), Pneumatic systems, Hydraulic systems, Fuel systems, Landing gear systems, Engine Control Systems, Ice and rain protection systems, Cabin Pressurization and Air Conditioning Systems, Steering and Brakes Systems Auxiliary Power Unit, Electrical

systems: Avionics, Flight controls, Autopilot and Flight Management Systems, Navigation Systems, Communication, Information systems, Radar System.

UNIT – IV

BASIC PRINCIPLES OF FLIGHT

Significance of speed of Sound, Air speed and Ground Speed, Properties of Atmosphere, Bernoulli's Equation, Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift, Drag, Pitching moments, Types of Drag, Lift curve, Drag Curve, Lift/Drag Ratio Curve, Factors affecting Lift and Drag, Center of Pressure and its effects. Aerofoil Nomenclature, Types of Aerofoil, Wing Section- Aerodynamic Center, Aspect Ratio, Effects of lift, Drag, speed, Air density on drag.

UNIT – V BASICS OF FLIGHT MECHANICS

Mach Waves, Mach Angles, Sonic and Supersonic Flight and its effects

STABILITY AND CONTROL

Degree of Stability- Lateral, Longitudinal and Directional Stability and controls of Aircraft. Effects of Flaps and Slats on Lift Coefficients, Control Tabs, Stalling, Landing, Gliding Turning, Speed of Sound, Mach Numbers, Shock Waves.

AIRCRAFT PERFORMANCE AND MANEUVERS

Power Curves, Maximum and minimum speeds of horizontal flight, Effects of Changes of Engine Power, Effects of Altitude on Power Curves, Forces acting on a Aeroplane during a Turn, Loads during a Turn, Correct and incorrect Angles of Bank, Aerobatics, Inverted Maneuvers, Maneuverability.

REFERENCES:

1. Flight without Formulae by A.C Kermode, Pearson Education,10th Edition.
2. Mechanics of Flight by A.C. Kermode, Pearson Education,5th Edition.
3. Fundamentals of Flight by Shevell, Pearson Education, 2nd Edition.
4. Introduction to Flight by Dave Anderson.
5. Aircraft Systems: Mechanical, Electrical & Avionics Subsystems Integration by Ian Moir, Allan Seabridge.
6. Aircraft Design-A Conceptual Approach by Daniel P. Raymer, AIAA education series,6th Edition.
7. Airframe Structural Design by Michael Niu, Conmilit Press, 1988, 2nd Edition.
8. Airframe Stress Analysis and Sizing by Michael Niu, Conmilit Press, 1999, 3rd Edition.
9. The Elements of Aircraft Preliminary Design by Roger D. Schaufele, Publisher: Aries.
10. Aircraft Structural Maintenance by Dale Hurst, Publisher: Avotek.
11. Aircraft Maintenance and Repair by Frank Delp, Michael J. Kroes & William A. Watkins, Glencoe, Publisher: McGraw-Hill.
12. An Introduction to Aircraft Certification; A Guide to Understanding Jaa, Easa and FAA by Filippo De Florio; Publisher: Butterworth-Heinemann.

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IV Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13MED112) CAD/CAM LAB

Course Prerequisites: CAD, CAM and SOM.

Course Objectives:

- Understand the ways in which 2D, 3D, part drawings and assembly drawings are made using appropriate CAD packages.
- Learn the part programming techniques in turning, milling and drilling operations.
- Understand the determination of stresses and strains in systems like trusses and beams.

Course Outcomes:

Students will be able to:

- Generate part and assembly drawings using CAD packages.
- Produce component with different features using CNC machines and machining centers.
- Determine the elastic properties in components of the structures.

12 exercises from the following syllabus:

1. CAD:

i)	2D Drawing using Sketcher workbench	–	1 exercise containing atleast 3 drawings
ii)	3D modeling using 3D features	–	1 exercise containing atleast 3 models
ii)	Assembly and drafting	–	1 exercise containing 1 assembly
iv)	Surface Modeling	–	1 exercise
v)	Sheet Metal Working	–	1 exercise

Softwares: **AutoCAD, IronCAD, CATIA, CREO**

2. CAM:

i) Part programming for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning operations.

ii) Part programming for Point to point motions, Linear motions, Circular interpolation, Contour motion, Pocket milling - Circular, Rectangular and Mirror commands.

iii) Part Programming using Fixed or Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning, Thread cutting.

iv) Generation of tool path, NC part program and its simulation.

v) Machining of small components using CNC Lathe, CNC Mill and CNC Turning center.

Softwares: **CNC Offline Simulation, EdgeCAM**

3. CAE:

a) Determination of deflection and stresses in 2D and 3D trusses and beams.

b) Determination Principal/ Von-mises stresses and deflections, in plane stress/ plane strain/ axisymmetric models.

c) Determination of stresses in 3D and shell structures.

Softwares: **Ansys**

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IV Year B.Tech. ME/ AE I Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13MED113)PRODUCTION DRAWING PRACTICE LAB

Course Prerequisites: Engineering drawing and Machine Drawing

Course Objectives:

- Understanding of conventional representations of various materials and machine components.
- Understanding limits, fits and tolerances and their representation in drawings.
- Understand part drawings procedures using CAD software

Course Outcomes:

Students will be able to:

- Represent various materials and machine components on part drawings
- Use limits fits and tolerances on drawings along with dimensions.
- Produce part and detailed drawings of various assemblies using cad.

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.

UNIT – II

Limits and Fits : Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

UNIT – III

Form and Positional Tolerances : Introduction and indication of the tolerances of form and position on drawings, deformation of runout and total runout and their indication.

UNIT – IV

Surface roughness and its indication : Definitions – finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components.

UNIT – V

Heat treatment and surface treatment symbols used on drawings.

UNIT – VI

Detailed and Part drawings: Drawing of parts from assembly drawings with indications of size, tolerances, Roughness, form and position errors etc.

UNIT – VII

Part drawing 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.

REFERENCE :

1. Geometric dimensioning and tolerancing- James D. Meadows/ B.S Publications.
2. Engineering Metrology, R.K. Jain, Khanna Publications.

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IV Year B.Tech ME/ AE I Sem	**L**	**T/P/D**	**C**
	0	**3**	**2**

(13MED114) AUTOMATION & ROBOTICS LABORATORY

Course Prerequisites: Manufacturing processes, fluid and electric controllers, robot programming, mathematics, Kinematics of machinery.

Course Objectives:

- To conduct the experiments for understanding the working of hydraulic, pneumatic, electric and electronic controls used in automation.
- To understand the concepts of PLC's, microcontrollers and automated transfer devices in automation by conducting experiments.
- To demonstrate the robotics manipulator motions using the robotic programming and languages.

Course Outcomes:

Students will be able to:

- Analyze the working of different controls used in automation.
- Able to design and analyze the hydraulic/pneumatic circuits.
- Able to write a robot program.

Experiments to demonstrate:

1. Limit stops and CAM control devices
2. Pneumatic, hydraulic, electrical systems in automation
3. Microprocessor applications in automated systems.
4. Robotics Systems and Programming
5. Automated transfer devices.
6. Training on Programmable Logic Controllers

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IV Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
	4	**0**	**4**

(13MED032) INDUSTRIAL ENGINEERING AND MANAGEMENT

Course Prerequisite: Knowledge of Manufacturing, General Management, Business Economics, Mathematics & Statistics

Course Objectives:

- Perform as industry leaders in the global marketplace, capable of successfully planning, controlling, and implementing large-scale projects.
- Flourish and work effectively in diverse, multicultural environments emphasizing the application of teamwork and communication skills.
- Understand and apply the principles of Management, science, technology, engineering, and mathematics involving industry-relevant problems.
- Maintain high standards of professional and ethical responsibility.
- Contribute to the profitable growth of industrial economic sectors by using IE analytical tools, effective computational approaches, and systems thinking methodologies.

Course Outcomes:

Students will be able to:

- Apply knowledge of Management, mathematics, science, and engineering.
- Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
- Communicate effectively.
- Function on multidisciplinary teams.
- Acquire knowledge on contemporary & emerging issues important to professional practice.

UNIT I

INTRODUCTION TO INDUSTRIAL ENGINEERING AND MANAGEMENT

Concept of Industrial Engineering (I.E),History and Development of I.E, Role of I.E, Applications of I.E, Production Management vs I.E, Principles of Management, Functions of Management, Taylor's Scientific Management, Maslow's Theory of Human Needs, Leadership Styles, Principles of Organization, Types of Organization Structures their Merits and Demerits, Entrepreneurship.

UNIT II

PRODUCTION AND OPERATIONS MANAGEMENT

Plant Location, Principles of Plant Layout, Different Types of Plant Layouts, different Types of Production Systems, Travel Chart Technique, Simple Problems on Assembly Line Balancing.

Production Planning and Control: Production Cycle, Product Design and Development, Production Planning and Control Techniques, Simple problems.

PLANT MAINTENANCE

Objectives and Types, Equipment Selection, Maintenance Planning.

Materials Handling- Principles, Concept of Unit Load, Containerization, Selection of Material Handling Equipment, Applications of Belt Conveyors, Cranes, Forklift Trucks in Industry.

UNIT III

WORK STUDY

Concept of Productivity, Method Study - Basic steps in Method Study, Process Charts, Diagrams, Models and Templates, Principles of Motion Economy, Micro Motion Study, Therbligs, SIMO Chart, PMTS, MOST, Work Measurement - Stop Watch Procedure of Time Study, Performance Rating, Allowances, Work Sampling, Simple Problems, Ergonomics.

MATERIALS MANAGEMENT

Introduction, Purchasing, Objectives of Purchasing Department, Buying Techniques, Purchase Procedure, Stores and Material Control, Inventory Control, EOQ Model(Simple Problems), Supply Chain Management.

Quality Control - Statistical Quality Control, Control Charts for Variables and Attribute, Simple Problems, Acceptance Sampling, Deming's Contribution to Quality. Total Quality Management, Taguchi's Quality Engineering, Value Analysis and Value Engineering

UNIT IV

MARKETING

Functions of Marketing, Marketing Mix, Product Life Cycle. Channels of Distribution and Sales Management.

Manufacturing planning: MRP, MRP-II, JIT, CIM.

UNIT V

HUMAN RESOURCES MANAGEMENT (HRM)

Concepts of HRM, Basic Functions of HR Manager: Manpower Planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal.

INDUSTRIAL RELATIONS

Trade Unions, Industrial Disputes, Strikes, Lock-Out, Picketing, Gherao, Settlement of Industrial Disputes, Collective Bargaining, Industrial Dispute Act 1947 and Factories Act 1948.

TEXT BOOKS:

1. Aryasri: Management Science, TMH, New Delhi, 2009.
2. Industrial Engineering and Management, by Dr. O. P .Khanna.

REFERENCES:

1. Principles of Management by Koontz and ODonnel.
2. Production and Operations Management by Everette Adam and Ronald Ebert.
3. Operations Management by John McClain and Joseph Thames.
4. Industrial Engineering and Production Management by Tulsa, S. Chand and Co.

VNR Vignana Jyothi Institute of Engineering and Technology

IV Year B.Tech ME II Sem	**L**	**T/P/D**	**C**
Elective IV	**3**	**1**	**3**

(13MED033) UNCONVENTIONAL MACHINING PROCESSES

Course Prerequisites: Manufacturing Technology & Engineering materials

Course Objectives:

- Understand the classification of various Non-Traditional machining processes and their applicability to various metals, non - metals & alloys
- Understand the working principles of mechanical energy based material removal processes
- Understand the Working principles of thermal energy and electrical energy based material removal processes
- Understand the working principles of chemical and electro-chemical based material removal processes

Course Outcomes:

Students will be able to:

- Gain the knowledge on various Non-Traditional machining methods which are applicable for difficult-to-cut materials, defense and aerospace sectors
- Decide on the process parameters to be adopted and applicability of various materials that are suitable for mechanical energy based machining processes
- Decide on the process parameters to be adopted and applicability of various materials that are suitable for electrical and thermal based machining processes
- Decide on the process parameters to be adopted and applicability of various materials that are suitable for chemical and electro-chemical energy based machining processes

UNIT I

INTRODUCTION

Unconventional Machining Process, Need, Classification, Brief overview of all techniques, Study of material removal phenomena.

UNIT II

MECHANICAL ENERGY BASED PROCESSES

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining-Ultrasonic Machining (AJM, WJM, AWJM, USM). Working Principles – equipment used – Process parameters – MRR – Applications.

UNIT III

ELECTRICAL ENERGY BASED PROCESSES

Electric Discharge Machining (EDM) - working Principles-equipments-Process Parameters-MRR- electrodes Used – Power Circuits – Dielectric – Flushing – Applications, Wire Cut EDM- Applications.

UNIT IV

CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES

Chemical Machining and Electro-Chemical machining (CHM and ECM)-Etchants-maskants -techniques of applying maskants-Process Parameters – MRR-Applications-Principles of ECM-equipments-MRR-Processes Parameters.

UNIT V

THERMAL ENERGY BASED PROCESSES

Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining (EBM), Principles-Equipment-Process Parameters - Applications.

TEXT BOOKS:

1. Advanced Machining Processes by Vijay K. Jain; Publisher: Allied Publishers.

REFERENCES:

1. Nontraditional Manufacturing Processes by Benedict. G. F; Publisher: Marcel Dekker.
2. Advanced Methods of Machining by McGeough; Publisher: Chapman and Hall, London.
3. Unconventional Machining Processes by P. K. Mishra; Publisher: Narosa.

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IV Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
Elective IV	**3**	**1**	**3**

(13MED034) NANO SCIENCE AND TECHNOLOGY

Course Prerequisites: Maths, Physics and chemistry.

Course Objectives:

- Understands the Nanomaterials and their properties.
- Understands the different nanostructures of carbon and its properties and their properties.
- Understands the applications of carbon nanotubes.

Course Outcomes:

Students will be able to:

- Know the importance and challenges of Nanoscience and Technology.
- Apply the fundamental knowledge science to characterize the Nano Materials.
- Synthesize carbon Nano tubes.

UNIT I

INTRODUCTION TO NANO

Importance, Definition and scope, Nano size, challenges, applications. Electrons**,** Atoms and Ions, Molecules**,** Metals**,** Other Materials**.**

HISTORY OF NANO-SCIENCE & TECHNOLOGY

Nano magnetism as a case study; Fundamental terms (Physics & Chemistry) in nano-science and technology; Feynman's perspective; Scaling laws pertaining to mechanics, optics, electromagnetism; Importance of Quantum mechanics, statistical mechanics and chemical kinetics in nano-science and technology;

UNIT II

CLASSIFICATION OF NANO MATERIALS

Scientific basis for top-down and bottom-up approaches to synthesize Nanomaterials; How to characterize Nanomaterials? Electrons in Nanomaterials.

TOOLS OF THE NANOSCIENCE

Tools for Measuring Nanostructures, Tools to Make Nanostructures. Nano scale Biostructures, Energy Capture, Transformation, and Storage Optics, Magnets, Fabrication, Electronics, Electronics Again Modelling.

UNIT III

NANO-BIOTECHNOLOGY

Bio-molecules; Biosensors; Nanomaterials in drug delivery; Working in clean room environments; Safety and related aspects of Nanomaterials.

UNIT IV

CARBON NANOTUBES & STRUCTURES

Carbon Nano structures and types of Carbon Nano tubes, growth mechanisms of carbon nanotubes. Carbon clusters and Fullerenes, Synthesis of CNTs by Flame, CVD, Laser & Arc-discharge process.

UNIT V

Lithium & Hydrogen adsorption & storages, Fuel cell applications and energy storage, Chemical Sensors applications of CNTs

TEXT BOOKS & REFERENCES:

1. Nanotechnology Fundamentals and Applications- by Manasi Karkare I.K International.
2. Nanoscience and Nanotechnology in engineering – by Vijay K Varadan A Sivathanupillai Word scientific.
3. Nanotechnology applications to telecommunications and networking By Daniel Minoli, Wiley Interscience.
4. Nanotechnology Principles and Applications by Sulabha Kulkarni.

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IV Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
Elective IV	**3**	**1**	**3**

(13MED036) DESIGN FOR MANUFACTURING

Course Prerequisites: Production Technology, Metallurgy & Material Science, Design Concepts, Automation, Machine Tools.

Course Objectives:

- Understand the design process and materials and their interrelationship.
- Understand design rules for various processes like machining, castings, metal joining, extrusion and sheet metal work.
- Understand manual and automatic assembly transfer systems.

Course Outcomes:

Students will be able to:

- Design components for ease of manufacturing depending on manufacturing process.
- Select materials conforming to design and having ease of manufacture.
- Design for manual and automatic - assembly transfer systems.

UNIT I

INTRODUCTION

Design philosophy, Steps in design process, General design rules for manufacturability, Basic principles of designing for economical production, Creativity in design - Design aspects covering environmental concerns, power consumption, operational safety and fool proofing.

MATERIALS

Selection of materials for design, commonly used metal sections, 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.

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.

UNIT III

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.

FORGING

Design factors for Forging, Closed die forging design, Parting lines of die drop forging die design, General design recommendations.

EXTRUSION AND SHEET METAL WORK

Design guidelines for extruded sections, Design principles for Punching, Blanking, Bending, Deep Drawing, Keeler Goodman Forming Line Diagram, Component design for Blanking.

UNIT-IV

ASSEMBLY ADVANTAGES

Development of the assembly process, Choice of assembly method, Assembly advantages, Social effects of automation.

AUTOMATIC ASSEMBLY TRANSFER SYSTEMS

Continuous transfer, Intermittent transfer, Indexing mechanisms and operator - paced free transfer machine.

UNIT-V

DESIGN OF MANUAL ASSEMBLY

General design guidelines for manual assembly, Development of the systematic DFA methodology, Assembly efficiency, Classification system for manual handling, Classification system for manual insertion and fastening, Effect of part symmetry on handling time, Effect of part thickness and size on handling time, Effect of weight on handling time.

TEXT BOOKS:

1. Assembly Automation and Product Design by Geoffrey Boothroyd, Publisher: Marcel Dekker Inc.,
2. Engineering Design – Material and Processing Approach by George E. Dieter, Publisher: McGraw Hill Intl.

REFERENCES:

1. Hand Book of Product Design by Geoffrey Boothroyd, Publisher: Marcel and Dekker
2. Computer Aided Assembly Planning by A. Delchambre, Publisher: Springer

IV Year B.Tech ME/ AE II Sem	L	T/P/D	C
Elective IV	3	1	3

(13MED037) PRINCIPLES OF ENTREPRENEURSHIP

Course Prerequisites: General Management & Financial Accounting concepts, Enthusiasm towards Entrepreneurship

Course Objectives:

- Understand the entrepreneurial process involved in creating, managing a new enterprise.
- Understand the background and tools necessary to participate in the entrepreneurial process
- Understand fundamental business framework.

Course Outcomes:

Students will be able to

- Identify the key steps required for exploiting an innovative idea or opportunity to develop an existing business, launch a new venture, or initiate a social enterprise.
- Recognize and evaluate business opportunities under dynamic economic settings.
- Identify and solve entrepreneurial issues while starting an enterprise.

UNIT I

INTRODUCTION TO ENTREPRENEURSHIP

Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs intrepreneur, The Entrepreneurial decision process, Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs, Opportunities for Entrepreneurs in India and abroad, Woman as Entrepreneur.

UNIT II

CREATING AND STARTING THE VENTURE

Sources of new Ideas, Methods of generating ideas, creating ideas and problem solving, product planning and development process.

UNIT III

THE BUSINESS PLAN, NEW VENTURE EXPANSION STRATEGIES AND ISSUES

Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities. Features and evaluation of joint ventures, mergers, acquisitions, franchising. Public issues, rights issues, bonus issues and stock splits.

UNIT IV

FINANCING AND MANAGING THE NEW VENTURE

Sources of capital, Record keeping, Recruitment, Motivating and leading teams, Financial controls, Marketing and sales controls, E-commerce and Entrepreneurship, Internet advertising.

UNIT V

INSTITUTIONAL SUPPORT TO ENTREPRENEURSHIP AND LABOUR LEGISLATION

Role of Directorate of Industries, District Industries Centers (DICs), Industrial Development Corporation (IDC), State Financial Corporation (SFCs), Small Scale Industries Development Corporations (SSIDCs), Khadi and Village Industries Commission (KVIC), Technical Consultancy Organization (TCO), Small Industries Service Institute (SISI), National Small Industries Corporation (NSIC), Small Industries Development Bank of India(SIDBI). Salient Provision under Indian Factories Act, Industrial Disputes Act, Employees State Insurance Act, Workmen's Compensation Act and payment of Bonus Act.

TEXT BOOKS:

1. Robert Hirsch and Michael Peters: Entrepreneurship, TMH, 5th Edition.
2. Dillinger: Entrepreneurship, 4/e, Pearson, 2004.

REFERENCES:

1. Vasant Desai**:** Dynamics of Entrepreneurial Development and management, Himalaya Publishing House, 2004.
2. Harvard Business Review on Entrepreneurship, HBR Paper Back, 1999.
3. Robert J.Calvin**:** Entrepreneurial Management, TMH, 2004.
4. Gurmeet Naroola**:** The Entrepreneurial Connection, TMH, 2001.
5. Bolton and Thompson**:** Entrepeneurs- Talent, Temperament, Technique, Butterworth Heinemann, 2001.
6. Agarwal: Indian Economy, Wishwa Prakashan 2005.
7. Duttand Sundaram: Indian Economy. S. Chand, 2005.
8. Srivastava**:** Industrial Relations and Labour Laws, Vikas, 2005.
9. Aruna Kaulgud**:** Entrepreneurship Management by Vikas Publishing House, 2003.
11. Thomas W. Zimmererand Norman M. Scarborough**:** Essential of Entrepreneurship and Small Business Management, PHI, 4/e, 2005.
12. Mary Coulter**:** Entrepreneurship in Action, PHI, 2/e, 2005.
13. Kaplan**:** Patterns of Entrepreneurship, Willey, 2005.
14. ND Kapoor**:** Industrial Law, Sultan Chandand Sons, 2005.

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IV Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
Elective IV	**3**	**1**	**3**

(13CSE077) INTERACTIVE COMPUTER GRAPHICS

Pre-requisites: C language, Engineering Graphics.

Course Objectives:

- Define computer graphics and explain applications of computer graphics and its systems.
- Illustrate basics of application programming interface (API) implementation based on graphics pipeline approach.
- Enabling students to have practical experience in the production of 2D, 3D Computer animation and Modeling techniques using various transformations.
- Explain the necessary knowledge and skills to extend core compositing and postproduction work using visual effects.

Course Outcomes:

- Apply the relevant mathematics of computer graphics and be able to write basic graphics application programs including animation
- Use the basic aspects of 2D image representations and transformations
- Implement different methods of digitally representing 3D Object representations and transformations.
- Name the traditional principles of visible surface detection methods that can be applied to computer animation.

UNIT I

INTRODUCTION:

Introduction, Application area of Computer graphics, Overview of graphic system, Display devices, Raster-scan systems, Random Scan Systems, Graphics Monitors and Work stations and Input devices.

UNIT II

OUTPUT PRIMITIVES:

Points and lines, Line drawing algorithms, Mid-point circle algorithm.

FILLED AREA PRIMITIVES:

Scan-line polygon fill algorithm, Boundary-fill and flood-fill algorithm

UNIT III

2-D GEOMETRICAL TRANSFORMATIONS:

Translation, scaling, rotation, reflection and shear transformation matrix representations and homogeneous co-ordinates, composite transformations, transformations between coordinates

2-D VIEWING:

The viewing pipe-line, Viewing coordinate reference frame, Window to view-port coordinate transformations, Viewing function, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland-Hodgeman polygon clipping algorithm.

UNIT IV

3-D OBJECT REPRESENTATION:

Polygon surfaces, Quadric surfaces, Spline representation, Hermite curve, Bezier curve and B-spline curve, Bezier and B-spline surfaces, Basic illumination models, Shading algorithms

3-D GEOMETRIC TRANSFORMATIONS:

Translation, Rotation, Scaling, Reflection and Shear transformation, Composite transformations

UNIT V

VISIBLE SURFACE DETECTION METHODS:

Classification, Back-face detection, Depth-buffer, Scan-line, Depth sorting, Area sub-division and octree methods

COMPUTER ANIMATION:

Design of Animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.

TEXT BOOKS:

1. Computer Graphics C version by Donald Hearn & M. Pauline Baker; Publisher: Pearson/PHI
2. Computer Graphics Principles and Practice / 2 edition in C/ Foley, VanDam, Feiner and Hughes/Pearson Education
3. CAD/CAM - Theory and Practice / Ibrahim Zeid / TMH

REFERENCES:

1. Computer Graphics/ 2 edition / Zhig and kiang, Roy Plastic, Schaum's outlines/TMH.
2. Procedural elements for Computer Graphics / David F Rogers / Tata Mc Graw hill/2nd edition.
3. Principles of Interactive Computer Graphics/Neuman and Sproul/TMH.
4. Principles of Computer Graphics/Shalini Govil

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IV Year B.Tech ME / AE II Sem	**L**	**T/P/D**	**C**
Elective V	**3**	**1**	**3**

(13MED038) PRODUCT LIFE CYCLE MANAGEMENT

Course Prerequisite: Mathematics, computers and use of software's packages.

Course Objectives:

- Understand PLM Strategies.
- Understand the principles of product life cycle.
- Understand business process.

Course Outcomes:

Students will be able to:

- Forecast the demand of the product.
- Develop a new product strategy.
- Predict the life cycle of product.

UNIT I

INTRODUCTION TO PLM

Need for PLM, opportunities and benefits of PLM, different views of PLM, components of PLM, phases of PLM, PLM feasibility study, PLM visioning.

PLM STRATEGIES

Industrial strategies, strategy elements, its identification, selection and implementation, change management for PLM.

UNIT II

PRODUCT DATA MANAGEMENT (PDM)

PDM systems and importance, reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation.

PRODUCT DESIGN

Engineering design, organization and decomposition in product design, product design process, methodical evolution in product design, concurrent engineering, design for 'X' and design central development model. Strategies for recovery at end of life, recycling, human factors in product design. Modeling and simulation in product design.

UNIT III

NEW PRODUCT DEVELOPMENT

Structuring new product development, building decision support system, Estimating market opportunities for new product, new product financial control, implementing new product development, market entry decision, launching and tracking new product program, Concept of redesign of product.

UNIT IV

TECHNOLOGY FORECASTING

Future mapping, invocating rates of technological change, methods of technology forecasting such as relevance trees, morphological methods and mission flow diagram, combining forecast of different technologies, uses in manufacture alternative.

UNIT V

PRODUCT CONCEPTION PROCESS

Business processes, data-process relationship, from the idea to waste disposal Product structures: Variant management, product configuration, material master data, product description data, Data models, Life cycles of individual items, status of items.

TEXT BOOKS:

1. Fabio Giudice, Guido La Rosa, Product Design for the environment-A life cycle approach, Taylor and Francis 2006.
2. Robert J. Thomas, NPD: Managing and forecasting for strategic processes.
3. Martins Joseph, Technological Forecasting for decision Making, 2nd edition, North Holland.

REFERENCES:

1. John Stark, Springer-Verlag, "Product Lifecycle Management Paradigm for 21st century Product Realization", London, 3rd printing (2006). 441 pp., ISBN: 1-85233-810-5.
2. Product Lifecycle Management, Michael Grieves, Tata McGraw Hill

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IV Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
Elective V	**3**	**1**	**3**

(13MED039) PLANT LAYOUT AND MATERIAL HANDLING SYSTEMS

Course Prerequisite: Knowledge of manufacturing, Operations Research.

Course Objectives:

- Understand plant layout system, its types and software tools used.
- Identify and learn elements of various material handling systems.
- Understand the benefit of an efficient material handling system and storage system

Course Outcomes:

Students will be able to:

- Design an appropriate plant layout for a plant.
- Flexible Plant layout to accommodate changes in product volume or product type.
- Recommended improvements to existing plant layouts from the stand point of material handling and product flow.

UNIT I

PLANT LAYOUTS

Fundamentals of plant layouts, Classification of layout, Advantages and limitations of different layouts. Layout design procedures. Process Layout and Product Layout: Comparison, Selection, Specification, Implementation and follow up.

UNIT II

Group Layout and Fixed Position Layout, Quadratic assignment model, Branch and bound method. Software tools used for making plant layouts – ALDEP, CORELAP, CRAFT; Case studies

UNIT III

ELEMENTS OF MATERIAL HANDLING SYSTEM

Importance; Terminology; Objectives and benefits of better material handling; Principles and features of Material Handling System; Interrelationships between material handling and plant layout; Physical facilities and other organizational functions; Classification of material handling equipments.

SELECTION OF MATERIAL HANDLING EQUIPMENTS

Factors affecting for selection; Material handling equation; Choices of material handling equipment; General analysis procedures; Basic analytical techniques; The unit load concept; Selection of suitable types of systems for applications; Activity cost data and economic analysis for design of components of material handling systems; Functions and parameters affecting service; Packing and storage of materials.

UNIT IV

HOISTS

Drives for hoisting; Components and hoisting mechanisms; Rail traveling components and mechanisms; Hoisting gear operation during transient motion; Selecting the motor rating and determining breaking torque for hoisting mechanisms.

CRANES

Hand-propelled and electrically driven E.O.T. overhead traveling cranes; Traveling mechanisms of cantilever and monorail cranes; Design considerations for structures of rotary cranes with fixed radius; Fixed post and overhead traveling cranes; Stability of stationary rotary and traveling rotary cranes.

ASRS

Introduction to ASRS and AGVS

UNIT V

LOAD LIFTING ATTACHMENTS

Load chains and types of ropes used in material handling system; Forged, Standard and ramshorn hooks; Crane grabs and clamps; Grab buckets; Electromagnet; Design consideration for conveyor belts; Application of attachments.

STUDY OF SYSTEMS AND EQUIPMENTS USED FOR MATERIAL STORAGE

Objectives of storage; Bulk material handling; Gravity flow of solids through slides and chutes; Storage in bins and hoppers; Belt conveyors; Bucket-elevators; Screw conveyors; Vibratory conveyors; Cabin conveyors; Mobile racks etc.

TEXT BOOKS:

1. Operations Management A Quantitative Approach by P. B. Mahapatra, Publisher: Prentice Hall International.
2. Operations Management by S. Anil Kumar, N. Suresh, Publisher: New Age Publishers.
3. Material Handling Equipment by N. Rudenko; Publisher: Peace publishers.
4. Facility Layout, Location and Analytical Approach by R. L. Francis, L. F. McLinnis Jr., White; Publisher: Prentice Hall International.
5. Aspects of Material Handling by Dr. K. C. Arora & Shinde; Publisher: Lakshmi Publications.

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IV Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
Elective V	**3**	**1**	**3**

(13MED040) COMPUTATIONAL FLUID DYNAMICS

Course Prerequisite: C Programming skills, Numerical Methods, Fluid Mechanics.

Course Objectives:

- Understand different methods involved in solving problem numerically.
- Formulate different kinds of physical problems with the different schemes and boundary conditions.
- Develop a code in a programming language to numerically solve a practical problem.

Course Outcomes:

Students will be able to:

- Solve fluid flow and heat transfer problems using numerical methods & Programming.
- Conduct the stability analysis and check the applicability of different schemes.
- Write algorithms to solve the complex non linear equations numerically and able to do a project demonstrating your understanding.

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/Hemashava Publishers Corporation &McGraw Hill.
2. Computational Fluid Flow and Heat Transfer/ Muralidaran/Narosa Publications.

REFERENCES:

1. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ McGraw 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.

IV Year B.Tech ME II Sem	L	T/P/D	C
Elective V	3	1	3

(13MED042) METAL CASTING TECHNOLOGY

Course Prerequisite: Production Technology

Course Objectives:

- Understand various casting processes and their application
- Understand the use of patterns and their design
- Understand the design of runner, riser and gating systems and allowances to be provided.

Course Outcomes:

Students will be able to:

- Select appropriate casting process for a component meeting design specifications.
- Design a part for casting and design a pattern based on the process
- Apply dynamic programming problem solving and simulation models.

UNIT – I

PATTERN AND FOUNDRY SAND

Foundry as manufacturing process- Types of patterns- Pattern Materials- Pattern Allowances- Pattern Layout, Pattern making- Various sands- Testing of foundry sand: Strength Permeability, Moisture Content.

UNIT – II

MOULDING METHODS

Moulding methods: Green sand moulding- dry sand moulding- no bake moulding- shell moulding- Investment casting- Permanent moulding- die casting and Centrifugal casting. Modern moulding methods: Rheocasting- Thixocasting and Squeeze casting.

UNIT – III

GATING AND RISERING

Solidification- Gates- their functions, design of gating system- Risers- their functions- design

UNIT – IV

MELTING FURNACES

Constructional details - Operation of crucible furnaces, Reverberatory furnaces- Cupola, Rotary furnace – Core type and Coreless type Induction furnaces - Arc furnace (direct and indirect arc furnaces).

UNIT – V

FETTLING AND INSPECTION

Removal of gates and risers, Grinding, Shot blasting and finishing, Inspection, Casting defects, Remedies.

TEXT BOOKS:

1. Principles of Metal Casting by Heine R. W, Loper C.R & Rosenthal P.C; Publisher: Tata McGraw Hill.
2. Principles of Foundry Technology by Jain P. L; Publisher: Tata McGraw Hill.

REFERENCES:

1. Metal Casting Principles and Practice by Ramana Rao T.V; Publisher: New Age.
2. Foundry Technology by Beeley P. R; Publisher: Butterworth.
3. Foundry Engineering by Srinivasan N. K., Publisher: Khanna.
4. Casting Vol. 15 by ASM Metals Hand Book; Publisher: ASM International.

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IV Year B.Tech ME/ AE II Sem	**L**	**T/P/D**	**C**
Elective V	**3**	**1**	**3**

(13MED043) DESIGN OF AIRCRAFT STRUCTURES

Course Prerequisites: Engineering Mechanics, Theory of Machines, Machine Design and Manufacturing Technology

Course Objectives:

- Understand design process and design of Aircraft structures.
- Understand materials and manufacturing processes applicable to Aircraft industry.
- Understand maintenance of Aircrafts and criteria of certification of Aircrafts.

Course Outcomes:

Students will be able to

- Design and analyze Aircraft structure.
- Decide material and manufacturing process applicable to Aircraft industry.
- Design maintenance programs for Aircrafts.

UNIT-I

OVERVIEW OF THE AIRCRAFT DESIGN PROCESS

Introduction, Phases of Aircraft Design, Aircraft Conceptual Design Process, Conceptual Stage, Preliminary Design, Detailed Design, Design Methodologies.

FUNDAMENTALS OF STRUCTURAL ANALYSIS

Review of Hooke's Law, Principal stresses, Equilibrium and Compatibility, Determinate Structures, St Venant's Principle, Conservation of Energy, Stress Transformation, Stress Strain Relations.

UNIT- II

INTRODUCTION TO AIRCRAFT STRUCTURES

Types of Structural members of Fuselage and wing section Ribs, Spars, Frames, Stringers, Longeron, Splices, Sectional Properties of structural members and their loads, Types of structural joints, Type of Loads on structural joints.

AIRCRAFT LOADS

Aerodynamic Loads, Inertial Loads, Loads due to engine, Actuator Loads, Maneuver Loads, VN diagrams, Gust Loads, Ground Loads, Ground conditions, Miscellaneous Loads.

UNIT-III

AIRCRAFT MATERIALS AND MANUFACTURING PROCESSES

Material selection criteria, Aluminum Alloys, Titanium Alloys, Steel Alloys, Magnesium Alloys, copper Alloys, Nimonic Alloys, Non Metallic Materials, Composite Materials, Use of Advanced materials Smart materials, Manufacturing of A/C structural members,

Overview of Types of manufacturing processes for Composites, Sheet metal Fabrication ,Machining, Welding, Superplastic Forming and Diffusion Bonding.

UNIT-IV

STRUCTURAL ANALYSIS OF AIRCRAFT STRUCTURES

Theory of Plates- Analysis of plates for bending, stresses due to bending, Plate deflection under different end conditions, Strain energy due to bending of circular, rectangular plates, Plate buckling, Compression buckling, shear buckling, Buckling due to in plane bending moments, Analysis of stiffened panels in buckling, Rectangular plate buckling, Analysis of Stiffened panels in Post buckling, Post buckling under shear, **Sample Exercises**.

Theory of Shells-Analysis of Shell Panels for Buckling, Compression loading, Shear Loading / Shell Shear Factor, Circumferential Buckling Stress, **Sample Exercises.**

Theory of Beams-Symmetric Beams in Pure Bending, Deflection of beams, Unsymmetrical Beams in Bending, Plastic Bending of beams, Shear Stresses due to Bending in Thin Walled Beams, Bending of Open Section Beams, Bending of Closed Section Beams, Shear Stresses due to Torsion in Thin Walled Beams. **Sample Exercises**.

Theory of Torsion- Shafts of Non-Circular Sections, Torsion in Closed Section Beams, Torsion in Open Section Beams, Multi Cell Sections, **Sample Exercises**.

UNIT-V

AIRWORTHINESS AND AIRCRAFT CERTIFICATION

Definition, Airworthiness Regulations, Regulatory Bodies, Type certification, General Requirements, Requirements Related to Aircraft Design Covers, Performance and Flight Requirements, Airframe Requirements, Landing Requirements, Fatigue and Failsafe requirements, Emergency Provisions, Emergency Landing requirements.

AIRCRAFT STRUCTURAL REPAIR

Types of Structural damage, Nonconformance, Rework, Repair, Allowable damage Limit, Repairable Damage Limit, Overview of ADL Analysis, Types of Repair, Repair Considerations and best practices.

REFERENCES:

1. Flight without Formulae by A.C Kermode, Pearson Education,10th Edition.
2. Mechanics of Flight by A.C Kermode, Pearson Education,5th Edition.
3. Fundamentals of Flight, Shevell, Pearson Education, 2nd Edition.
4. Introduction to Flight by Dave Anderson.
5. Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration by Ian moir, Allan Seabridge.
6. Aircraft Design - A Conceptual Approach by Daniel P.Raymer, AIAA education series,6th Edition.
7. Airframe Structural Design by Michael Niu, Conmilit Press, 1988,2nd Edition.
8. Airframe Stress Analysis and Sizing by Michael Niu, Conmilit Press, 1999,3rd Edition.

9. The Elements of Aircraft Preliminary Design – Roger D. Schaufele, Aries Publications, 2000.
10. Aircraft Structural Maintenance by Dale Hurst, Avotek publishers, 2nd Edition, 2006.
11. Aircraft Maintenance and Repair by Frank Delp, Michael J. Kroes & William A. Watkins, Glencoe and McGraw-Hill,6th Edition, 1993.
12. An Introduction to Aircraft Certification; A Guide to Understanding Jaa, Easa and FAA by Filippo De Florio, Butterworth-Heinemann.

VNR Vignana Jyothi Institute of Engineering and Technology

IV Year B.Tech. M.E. II-Sem	**L**	**T/P/D**	**C**
Elective V	**3**	**1**	**3**

(13MED044) POWER PLANT ENGINEERING

Course Prerequisites: Thermal Engineering and Basic Electrical Engineering.

Course Objectives:

- Understand the layout of the different types of Power plants.
- Knowledge on various components in the power plants.
- Knowledge on Nuclear power generation
- Understand the power plant economics and power distribution.

Course outcomes:

Students will be able to:

- Working principal of the power plant , scope for future expansion and knowledge on various equipments in the plant.
- Know the power generation through Nuclear fuel and safety measure while using the nuclear fuel for power generation.
- Have an awareness on effluents from power plants and impact on environment – pollution control.
- Know about the power distribution and load factor importance.

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..

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 – Cost of Diesel power Plant – Testing Diesel Power Plant Performance.

UNIT III

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.

HYDRO ELECTRIC POWER PLANT: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.

HYDRO PROJECTS AND PLANT: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

UNIT IV

POWER FROM NON-CONVENTIONAL SOURCES: Utilization of Solar energy - Collectors- Fuel CellsPrinciple of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

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 BOOK :

1. A Text Book of Power Plant Engineering / Rajput / Laxmi Publications
2. Power Plant Engineering – G.R. Nagpal/ Khanna Publishers

REFERENCES :

1. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
2. Power plant Engineering/ Ramalingam/ Scietech Publishers
3. Power Plant Engineering – P.C.Sharma / S.K.Kataria Pub
4. A Course in Power Plant Engineering: / Arora and S. Domkundwar.
5. Power station Engineering – ElWakil / McHill.
6. An Introduction to Power Plant Technology / G.D. Rai.
7. Power plant Engg - Elanchezhian- I.K. International Pub.