ACADEMIC REGULATIONS

COURSE STRUCTURE AND

DETAILED SYLLABUS

AUTOMOBILE ENGINEERING

B.TECH. FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2015-2016)

VALLURUPALLI NAGESWARA RAO VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous Institute, Accredited by NAAC with 'A' Grade
NBA Accreditation for CE, EEE, ME, ECE, CSE, EIE, IT B.Tech. Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O), Hyderabad – 500 090, TS, India.
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Vision and Mission of the Institute

VISION

To be a World Class University providing value-based education, conducting interdisciplinary research in cutting edge technologies leading to sustainable socio-economic development of the nation.

MISSION

- To produce technically competent and socially responsible engineers, managers and entrepreneurs, who will be future ready.
- To involve students and faculty in innovative research projects linked with industry, academic and research institutions in India and abroad.
- To use modern pedagogy for improving the teaching-learning process.

Vision and Mission of the Department

VISION

To become and be one of the elite technical institutes acclaimed by the peers and industry with world class technical education, contemporary teaching facility and state-of-the-art laboratories to suit global standards

MISSION

- Provide engineering education with highest learning standards for designing and manufacturing of world class automobiles
- Foster research, evolve innovative applications of state-of-the-art automotive technology, promote entrepreneurship and ultimately mould young men and women by inculcating ethical leadership qualities for the benefit of the society

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

HYDERABAD

An Autonomous Institute

ACADEMIC REGULATIONS FOR B.TECH. PROGRAMME

(Applicable for Students admitted from the academic year 2015-2016)

1. Programmes of study

- The following four year B.Tech. degree programmes of study are offered at VNR VJIET from the academic year 2017-2018.

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

- **'ENGLISH'** language is used as the medium of instruction in all the above programmes.

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 recognized by BIE, Telangana State

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

Category – A Seats:

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

Category - B Seats:

These seats shall be filled by the Institute as per the G.Os issued by the State Government from time to time.

1.1.2 Category: Lateral Entry

The candidate shall be admitted into the Third Semester, (2^{nd} year, 1^{st} semester) based on the rank secured by the candidate in Engineering Common Entrance Test (ECET (FDH)) by the Convener, ECET.

2. Distribution and Weights 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 **40 marks for Mid-term Evaluation** and **60 marks for the Semester End Examination**.

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Mid-Term Evaluation (40 M):

Mid-term evaluation consists of mid-term examination (30 M) and assignment/test (10 M).

- **Mid-term examination (30 M):**

- For theory subjects, two mid examinations shall be conducted in each semester as per the academic calendar. Each mid examination shall be evaluated for 30 marks.
  PART-A 3 X 2M = 6 M (one question from each UNIT)
  PART-B 3 X 8 M = 24 M (three internal choice questions one from each UNIT shall be given, the student has to answer one question from each UNIT)
- 80 % weightage for better mid-term examination and 20% weightage for the other mid examination shall be used and calculated as the final mid-term examination marks for each subject.

- **Assignment/objective exam/ case study/course project (10 M):**

- Two assignment/objective exam/ case study/course project shall be given to the students covering the syllabus of First Mid and Second Mid Examinations respectively and evaluated for 10 marks each.

- The first assignment shall be submitted before first mid examination and second assignment shall be submitted before second mid examination.
- The average of 2 assignments shall be taken as final assignment marks.

iii. For practical subjects, there shall be a **continuous evaluation during the semester for 40 marks and 60 marks for semester end examination**. Out of the 40 marks, **day-to-day work in the laboratory shall be evaluated for 10 marks**, and **15 marks for practical examination** and **15 marks for laboratory record.**

NOTE: 1. Any student who shall remain 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.

2. Evaluation guidelines available with respective HOD's.

iv. For the subjects having design and / or drawing, (such as Engineering Graphics, Geometrical Drawing, Machine Drawing, Production Drawing Practice, and Estimation etc.,) the distribution shall be **40 marks for internal evaluation (20 marks for day-to-day work and 20 marks for Mid examination (**the average of the two examinations shall be taken into account**) and 60 marks for semester end examination.**

NOTE: Evaluation guidelines available with respective HOD's.

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 presented before a committee, which shall evaluate it for **100 marks.** The committee shall consist 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 or any such other programme, in lieu thereof, is a pre-requisite for evaluating industry-oriented mini project.**

NOTE: Evaluation guidelines available with respective HOD's.

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 shall be evaluated for 100 marks based on the report and presentation made.**

NOTE: Evaluation guidelines available with respective HOD's.

vii. There shall be a **comprehensive viva-voce in IV year II semester**. The comprehensive viva-voce shall be conducted by a committee consisting of the Head of the Department and three senior faculty members of the Department **after submitting the filled and duly signed M.T.P record**. The comprehensive viva-voce is aimed to assess the student's understanding in various subjects studied during the B.Tech. programme of study. The comprehensive viva-voce shall be evaluated **for 100 marks** by the committee. There shall be **no Mid-term assessment for the comprehensive viva-voce.**

Evaluation:-

a. Objective type examination – 50 marks. (Two hours test)
b. Committee evaluation – 50 marks.

NOTE: Evaluation guidelines available with respective HOD's

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, **80 marks shall be for mid-term evaluation** and **120 marks for the semester end examination**. The viva-voce shall be conducted by a committee comprising an external examiner, Head of the Department, 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 mid-term evaluation shall be on the basis of three seminars conducted during the IV year II semester for 80 marks by the committee consisting of Head of the Department, project supervisor and senior faculty member of the Department.**

NOTE: Evaluation guidelines available with respective HOD's

3. Semester End Examination (60 M):

(a) Theory Courses

Question paper pattern for semester end examination (60 Marks) consists of two sections i.e., Part-A and Part-B.

PART-A:

- Shall consist of 10 questions of 02 marks each. (10X2M = 20M)
- There shall be 02 questions from each unit.
- All the questions are compulsory.

PART-B:

- Shall consist of 05 questions of 08 marks each. (05X8M = 40M)
- There shall be 01 question from each unit with internal choice.

(b) Practical Courses

Each laboratory course shall be evaluated for 60 marks. The semester end examination shall be conducted by two examiners, one Internal and other external concerned with the subject of the same / other department / Industry. The evaluation shall be as per the standard format.

(c) Supplementary Examinations

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

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 courses** in that semester.

ii. Shortage of attendance in aggregate **up to 10% (attendance of 65% and above and below 75%)** in a semester may be condoned by the **Institute Academic Committee based on the rules prescribed by the Academic Council of the Institute from time to time.**

iii. A student shall not be permitted to write the semester end examination and not promoted to the next semester unless he/she satisfies the attendance requirement of the present semester, as applicable. He/She may seek re-admission for that semester when offered next, if not promoted to the next semester.

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

v. Students whose shortage of attendance is not condoned or who have not paid the stipulated fee or who have not cleared any other due to the Institute in any semester are not eligible to writer semester end examination of that semester.

5. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in Regulation 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 or design or drawing subject or project, if he/she secures **not less than 35% (21 out of 60 marks) of marks in the semester end examination and a minimum of 40% of marks in the sum total of the mid-term evaluation and semester end examination taken together.**

ii. For promotion from II year II semester to III year I semester, the student needs to have 50% of credits up to II year II semester which includes

- Two regular and two supplementary examinations of I B Tech. I semester.
- Two regular and one supplementary examinations of I B Tech. II semester
- One regular and one supplementary examinations of II year I semester.
- One regular examinations of II year II semester.

iii. For promotion from III year II semester to IV year I semester, the student needs to have 50% of credits up to III year II semester which includes
- Three regular and three supplementary examinations of I B Tech. I semester.
- Three regular and two supplementary examinations of I B Tech. II semester
- Two regular and two supplementary examinations of II year I semester.
- Two regular and one supplementary examinations of II year II semester.
- One regular and one supplementary examination of III year I semester.
- One regular examination of III year II semester.

iv. A student shall register and put up minimum academic requirement in all **188 credits and earn atleast 180 credits for the award of B.Tech. degree.** The grade obtained for the minimum credits shall be considered for the calculation of CGPA.

v. The students shall take one open elective subject each from the lists given in open elective-1 and open elective-2. The selected subjects shall not belong to their own branch.

vi. The student shall be qualified in **two certificate courses** during his/her course of study.

vii. "Gender Sensitization" is compulsory value added course as per the JNTUH procds. No. A1/2557/XXII SCAS/2015(2), dated 19.11.2015.

viii. Students who fail to earn atleast 180 credits as indicated in the course structure **within eight academic years counting** from the year of their admission shall **forfeit their seat** in B.Tech. programme and their **admission stands cancelled.**

6. Course pattern

i. The entire programme 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 semester end examination in a subject, but absent or has failed in the semester end examination may reappear for that subject in the supplementary examination whenever conducted.

iii. When a student is detained due to shortage of attendance in any semester, he/she shall seek readmission into that semester when it is offered next, **with the academic regulations of the batch into which he/she gets readmitted and has to obtain the degree within 8 academic years from the year of his/her original admission.**

iv. When a student is detained due to lack of credits in any year, he/she may be eligible for promotion to the next year after obtaining the required number of credits and fulfillment of the academic requirements.

7. Award of B.Tech. Degree and Class

A student shall be declared eligible for the award of the B. Tech. degree if he/she fulfils the following academic regulations:

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

ii. Registered for **188 credits** and secured a minimum of **180 credits with compulsory subjects as listed in the following Table.**

Table: Compulsory Courses

S. No.	Courses Particulars
1.	All Practical Courses
2.	Industry oriented mini project
3.	Comprehensive Viva-Voce
4.	Seminar
5.	Project work
6.	Engineering Graphics / Engineering Drawing / Machine Drawing

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. programme.

8. CGPA System:

Method of awarding absolute grades and grade points in four year B.Tech. degree programme is as follows:

- Absolute Grading Method is followed, based on the total marks obtained in mid-term and semester end 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**	**Fail**	**--**
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 following 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**

- **Calculation of Semester Grade Points Average (SGPA):**

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

$$\text{SGPA} = \frac{\text{Total earned weighted grade points in a semester}}{\text{Total credits in a semester}}$$

$$\text{SGPA} = \frac{\sum_{i=1}^{p} C_i * G_i}{\sum_{i=1}^{p} C_i}$$

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

Gi = Grade point corresponding to the letter grade awarded to the subject 'i'

i = 1,2,…..p represent the number of subjects in a particular semester

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

- **Calculation of Cumulative Grade Point Average (CGPA):**

  The CGPA of a student for the entire programme shall be calculated as given below:

  - Assessment of the overall performance of a student shall be 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.

$$\text{CGPA} = \frac{\text{Total earned weighted grade points for the entire programme}}{\text{Total credits for the entire programme}}$$

$$\text{CGPA} = \frac{\sum_{j=1}^{m} C_j * G_j}{\sum_{j=1}^{m} C_j}$$

Where Cj = Number of credits allotted to a particular subject 'j'

Gj = Grade Point corresponding to the letter grade awarded to that subject 'j'

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

  - Grade lower than D in any subject shall not be considered for CGPA calculation. The CGPA shall be 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.

9. Withholding of Results

If the student has not paid dues to the Institute, or if any case of indiscipline is pending against him, the result of the candidate may be withheld. The award or issue of the Provisional Certificate and the Degree may also be withheld in such cases.

10. 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 subjects in place of repeated subjects as decided by the Chairman of the BoS of the respective departments. He/She shall be admitted under the regulation of the batch in which he/she is readmitted.

11. Minimum Instruction Days

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

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

13. The decision of the Institute Academic Committee shall 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 be approved by the Governing Council of the Institute.

14. 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 arising in the above rules and regulations, the decision of the Principal shall be final.

iv. The Chairman 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.

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

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

A student shall be declared eligible for the award of the B. Tech. degree if he/she fulfils the following academic regulations:

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

ii. Registered for **138 credits** and secured a minimum of **130 credits with compulsory subjects as listed in the following Table.**

Table: Compulsory Courses

S. No.	Courses Particulars
1.	All Practical Courses
2.	Industry oriented mini project
3.	Comprehensive Viva-Voce
4.	Seminar
5.	Project work
6.	Engineering Graphics / Engineering Drawing / Machine Drawing

iii. A student who **fails to earn a minimum of 130 credits** as indicated in the course structure **within six academic years** from the year of their admission shall **forfeit his/her seat in B.Tech. programme and his admission stands cancelled.**

iv. The same attendance regulations are adopted as that of B.Tech. four year degree course.

v. For promotion from III year II semester to IV year I semester, the student needs to have 50% of credits up to III year II semester which includes

- Two regular and two supplementary examinations of II B Tech. I semester
- Two regular and one supplementary examinations of II B Tech. II semester
- One regular and one supplementary examinations of III B.Tech. I semester
- One regular of examinations of III year II semester

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

16. Malpractice Rules

Disciplinary Action for Malpractices/Improper Conduct in Examinations

S. No.	Nature of Malpractices/Improper conduct If the candidate:	Punishment
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	Expulsion from the examination hall and cancellation of the performance in that subject only.

	candidate which can be used as an aid in the subject of the examination)	
	(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 shall 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 shall 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 and supplementary 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 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	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates are also debarred and they shall forfeit their seats. In

	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.	case of outsiders, they shall 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.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the 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 any of clauses 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 shall be handed over to police and, a police case shall 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 series of the 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 shall be given 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 shall meet and discuss/question the candidate and based on the evidences, the committee shall 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, examiners valuing examination papers and preparing / keeping records of documents related to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examinations shall be viewed seriously and recommend for award of appropriate punishment after thorough enquiry.
4) Based on the explanation by the party involved and recommendations of the committee action may be initiated.

5) Malpractice committee:

i.	Dean, Academics	Chairman
ii.	Controller of Examinations	Convener
iii.	Invigilator	Member
iv.	Chief Examiner of the subject/subject expert	Member
v.	Concerned Head of the Department	Member

Programme Educational Objectives

The under-graduate programme in Automobile Engineering will be able to

1. Provide a strong foundation in mathematical, scientific and engineering fundamentals that enable the students to formulate, analyze and solve engineering problems and to prepare them for graduate studies
2. Apply knowledge and concepts of automotive technology to synthesize data and solve multi-disciplinary engineering problems
3. Continue to work as part of teams for successful career in automotive and ancillary industry that meet the needs of Indian and multinational companies
4. Undertake research and development projects with multi-disciplinary approach which are cost effective and efficient so as to resolve automotive engineering issues of social relevance
5. Demonstrate their professional, ethical and social responsibilities for a successful professional career and contribute their part for addressing various global issues

Program Outcomes

The students of Automobile Engineering will be able to

a) Apply acquired knowledge from undergraduate engineering and other disciplines to identify, formulate and present solutions to technical problems related to various areas of Automobile Engineering.

b) Learn advanced technologies and analyze complex problems in the fields of Automobile Engineering.

c) Design and implementation of Automotive systems using Auto CAD/CREO/ANSYS/CATIA

d) Addressing specific problems in the field of automotive system design in the form of mini projects, analysis, and interpretation of data and synthesis of information to provide valid conclusions.

e) Use the techniques, skills, latest Modelling / Design / Analysis / Simulation tools, software and equipment necessary to evaluate and analyze the systems in automotive design environments.

f) Understand and commit to professional ethics, social responsibilities and norms of engineering practice.

g) Develop confidence for self-education and imbibe professional values for lifelong learning.

h) Demonstrate effective oral and written communication skills in accordance with technical standards.

i) Become knowledgeable about contemporary developments.

j) Ability to correct the mistakes effectively and learn from them to become good leaders.

k) Understand the scenario of global business.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
B.TECH. AUTOMOBILE ENGINEERING

I YEAR I SEMESTER **COURSE STRUCTURE**

Course Code	Course Name	Lectures	T/P/D	Credits
5BS11	Advanced Calculus	3	0	3
5BS21	Engineering Physics	3	0	3
5BS31	Chemistry of Engineering Materials	3	0	3
5IT01	C Programming and Data Structures	3	1	4
5CE01	Engineering Mechanics – I	3	1	4
5ME51	Engineering Graphics – I	0	6	3
5BS25	Engineering Physics and Chemistry Laboratory	0	3	2
5IT51	C Programming and Data Structures Laboratory	0	3	2
Total		**15**	**14**	**24**

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
B.TECH. AUTOMOBILE ENGINEERING

I YEAR II SEMESTER **COURSE STRUCTURE**

Course Code	Course Name	Lectures	T/P/D	Credits
5CE03	Environmental Studies	3	0	3
5BS12	Ordinary Differential Equations and Laplace Transforms	3	0	3
5BS22	Physics of Materials	3	0	3
5BS32	Engineering Chemistry	3	0	3
5BS01	English	3	0	3
5CE02	Engineering Mechanics – II	3	1	4
5ME52	Engineering Graphics - II	0	6	3
5ME53	IT and Engineering Workshop	0	3	2
5BS02	English Language Communication Skills Laboratory	0	3	2
Total		**18**	**13**	**26**

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
B.TECH. AUTOMOBILE ENGINEERING

II YEAR I SEMESTER **COURSE STRUCTURE**

Course Code	Course Name	Lectures	T/P/D	Credits
5BS14	Partial Differential Equations with Applications and Complex Analysis	3	0	3
5ME01	Mechanics of Solids	3	0	3
5ME02	Thermodynamics	3	1	4
5ME03	Metallurgy and Material Science	3	0	3
5ME04	Fluid Mechanics and Hydraulic Machines	3	0	3
5ME54	Metallurgy and Material Science Laboratory	0	3	2
5ME55	Mechanics of Solids Laboratory	0	3	2
5ME56	Fluid Mechanics and Hydraulic Machines Laboratory	0	3	2
Total		**15**	**10**	**22**

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
B.TECH. AUTOMOBILE ENGINEERING

II YEAR II SEMESTER **COURSE STRUCTURE**

Course Code	Course Name	Lectures	T/P/D	Credits
5BS13	Computational Methods	3	0	3
5AE01	Applied Thermodynamics	3	1	4
5AE02	Automotive Engines and Systems	3	0	3
5AE03	Theory of Machines	3	1	4
5EE23	Basic Electrical and Electronics Engineering	3	0	3
5ME57	Machine Drawing	0	6	3
5AE51	Automotive Engines Laboratory	0	3	2
5EE63	Basic Electrical and Electronics Engineering Laboratory	0	3	2
Total		**15**	**14**	**24**
#5BS04	Gender Sensitization	-	3	2

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

Value added Course

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
B.TECH. AUTOMOBILE ENGINEERING

III YEAR I SEMESTER **COURSE STRUCTURE**

Course Code	Course Name	Lectures	T/P/D	Credits
5AE04	Automotive Chassis	3	0	3
5AE05	Automotive Electrical and Electronics	3	0	3
5AE06	Automobile Engineering Design - I	3	1	4
5ME07	Production Technology	3	0	3
5ME10	Heat and Mass Transfer	3	0	3
	Open Elective I	3	0	3
5ME59	Production Technology Laboratory	0	3	2
5ME60	Heat and Mass Transfer Laboratory	0	3	2
Total		**18**	**7**	**23**

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

OPEN ELECTIVE I

Course Code	Course Name	Course Offered by the Department
5CE71	Disaster Management	CE
5EE71	Renewable Energy Technologies	EEE
5ME71	Digital Fabrication	ME
5EC71	Principles of Electronic Communications	ECE
5CS71	Object Oriented Programming through JAVA	CSE
5EI71	Principles of Measurements and Instrumentation	EIE
5IT71	Cyber Security	IT
5AE71	Principles of Automobile Engineering	AE
5BS71	Professional Ethics and Human Values	H&S

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
B.TECH. AUTOMOBILE ENGINEERING

III YEAR II SEMESTER **COURSE STRUCTURE**

Course Code	Course Name	Lectures	T/P/D	Credits
5BS41	Business Economics and Financial Analysis	3	0	3
5AE07	Automobile Engineering Design - II	3	1	4
5AE08	Vehicle Dynamics	3	0	3
5AE09	Machine Tools and Metrology	3	0	3
	Open Elective II	3	0	3
5ME61	Machine Tools and Metrology Laboratory	0	3	2
5BS03	Advanced English Communication Skills Laboratory	0	3	2
5AE52	Automobile Engineering Laboratory	0	3	2
Total		**15**	**10**	**22**

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

OPEN ELECTIVE II

Course Code	Course Name	Course Offered by the Department
5CE72	Introduction to Geographical Information System	CE
5EE72	Energy Auditing Conservation and Management	EEE
5ME72	Optimization Techniques	ME
5EC72	Introduction to Micro Processors and Controllers	ECE
5EC95	Wireless Communications and Networks	ECE
5CS72	Open Source Technologies	CSE
5EI72	LabVIEW Programming	EIE
5EI79	Fundamentals of Robotics	EIE
5IT72	Relational Database Management Systems	IT
5AE72	Modern Automotive Technologies	AE
5BS72	Entrepreneurship	H&S

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
B.TECH. AUTOMOBILE ENGINEERING

IV YEAR I SEMESTER **COURSE STRUCTURE**

Course Code	Course Name	Lectures	T/P/D	Credits
5AE10	Electric and Hybrid Vehicles	3	0	3
5AE11	Industrial Engineering and Operations Research	3	1	4
5ME16	CAD/CAM	3	0	3
	Elective I	3	0	3
5AE73	Vehicle Body Engineering and Safety			
5AE74	Fuel Cell Technology			
5ME74	Automation and Robotics			
5ME76	Quality Engineering in Manufacturing			
	Elective II	3	0	3
5AE81	Finite Element Analysis			
5AE75	Automotive Infotronics			
5ME77	Computational Fluid Dynamics			
5ME80	Product Life Cycle Management			
5AE53	Vehicle Maintenance and Testing Laboratory	0	3	2
5ME62	CAD/CAM Laboratory	0	3	2
5AE54	Vehicle Dynamics and Autotronics Laboratory	0	3	2
5AE91	Industry Oriented Mini Project	0	4	2
Total		**15**	**14**	**24**

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
B.TECH. AUTOMOBILE ENGINEERING

IV YEAR II SEMESTER **COURSE STRUCTURE**

Course Code	Course Name	Lectures	T/P/D	Credits
5AE12	Refrigeration and Auto Air Conditioning	3	0	3
	Elective III	3	0	3
5AE76	Alternative Fuels and Technologies			
5AE77	Fluid Power Systems			
5ME82	Design for Manufacturing			
5ME84	Principles of Entrepreneurship			
	Elective IV	3	0	3
5AE78	Automotive Pollution and Control			
5AE79	Plant Layout and Material Handling Systems			
5AE80	Composite Materials			
5ME88	Nano Science and Technology			
5AE92	Technical Seminar	0	3	2
5AE93	Comprehensive Viva Voce	0	0	2
5AE94	Project Work	0	20	10
Total		**9**	**23**	**23**

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Year I Semester

L	T/P/D	C
3	0	3

(5BS11) ADVANCED CALCULUS

(Common to CE, EEE, ME, ECE, CSE, EIE, IT & AE)

Course prerequisites: Differentiation and Integration

Course Objectives

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

Course Outcomes

After completion of the course the student is able to

- **Solve** problems involving the maxima and minima of f(x,y)
- **Trace** curves using basic characteristics
- **Evaluate** integrals using special functions and change of variables
- **Evaluate** vector integrals

UNIT I

Calculus of One and Several Real Variables: Mean value thoerems – Rolle's thoerem, Lagrange's mean value theorem, 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, change of variables, Jacobian, Taylor's theorem of two variables(without proof). Maxima and Minima of two variables and Langrange's method of undetermined multipliers.

UNIT II

Curve Tracing and Related Applications: Radius of 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 and Lemniscate).

UNIT III

Multiple Integrals: Beta, gamma and error functions, introduction of multiple integrals, evaluation of double and triple integrals, change of order of integration, change of variables, cylindrical and spherical polar coordinates.

UNIT IV

Vector Differential Calculus: Scalar and vector point functions, gradient, divergence, curl with geometrical and physical interpretation, directional derivatives and vector identities (without proofs).

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 and Stokes' theorem (theorems without proof).

TEXT BOOKS

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

REFERENCES

1. Advanced Engineering Mathematics by Erwin Kreyszig, 8th edition; Publisher: John Wiley.
2. Advanced Engineering Mathematics by Peter 'O' Neil, publisher: Cengage Learning.
3. Advanced Engineering Mathematics by R.K.Jain and S.R.K.Iyengar; Publisher: Narosa.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Year I Semester

L	T/P/D	C
3	0	3

(5BS21) ENGINEERING PHYSICS

(Common to CE, EEE, ME, ECE, CSE, EIE, IT & AE)

Course Objectives

- **Supplement** and **enhance** the knowledge of basic concepts in physics essentially required in the study of interaction of light with matter and behavior of a particle quantum mechanically
- **Study** and **understand** various phenomena of light- Interference, diffraction, dispersion and total internal reflection
- **Learn** and **enhance** the basic concepts in physics required to deal with large number of particles and behavior of an electron in metals
- **Understand** the basic principles and working of lasers and optical fibers
- Learn simple applications of these concepts and principles in engineering and technology

Course Outcomes

After completion of the course the student is able to

- **Realize** influence of diffraction and resolvability in optical elements
- **Recognize** importance of interference in thin films
- **Distinguish** LASER light from ordinary light and describe propagation of light through optical fiber by total internal reflection.
- **Illustrate** behavior of a particle in one dimensional potential box
- **Understand** behavior of electron in a periodic potential in real crystal and classify solids based on conduction.

UNIT I

Interference: Introduction, 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 - Formation of rings and experimental method, characteristics of rings, applications.

UNIT II

Diffraction: Introduction, distinguish between Fraunhofer and Fresnel diffraction, diffraction at single slit (Qualitative and Quantitative (Phasors approach)). Diffraction at double slit, circular aperture, and multiple slits (grating)(Qualitative Approach)-Width of principal maxima and dispersion, resolution of spectral lines, Rayleigh criterion, and resolving power of grating.

UNIT III

Lasers and Optical Fibers: Introduction, 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, principle of optical fiber and properties, acceptance angle and acceptance cone, numerical aperture, types of fibers based on refractive index profiles, qualitative analysis of attenuation in optical fibers, application of lasers and optical fibers.

UNIT IV

Elements of Quantum Mechanics: Waves and particles, De Broglie hypothesis, matter waves, Davisson and Germer experiment, Heisenberg's uncertainty principle- Applying it to Non existence of electron in Nucleus and single slit experiment, Schrodinger Wave Equation – Wave function and its physical significance, particle in one dimensional potential box(wave functions, probability densities and energy states), Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics (non-mathematical treatment).

UNIT V

Electron Theory of Metals: Energy levels in one dimension, effect of temperature on the Fermi-Dirac distribution, Electrical conductivity & Ohm's law, electrical resistivity of metals (Qualitative), 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 and insulators and concept of effective mass of an electron.

TEXT BOOKS

1. Physics vol.2, by Halliday, Resnick and Krane; John Wiley & Sons.
2. Engineering Physics by R.K.Gaur and S.L.Gupta; Dhanpat Rai and Sons.

REFERENCE BOOKS

1. Optics by Ghatak and Thyagarajan, Tata Mc Graw.
2. Concepts of Modern physics by Arthur Beiser, McGraw Hill Inc.
3. Introduction to Solid State Physics by Charles Kittel : John Wiley & Sons.
4. Applied Physics by P.K.Mittal, IK International Publishing House (P) Ltd.
5. Engineering Physics by G Sahashra Buddhe; University Press.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Year I Semester

L	T/P/D	C
3	0	3

(5BS31) CHEMISTRY OF ENGINEERING MATERIALS

(Common to CE, ME & AE)

Course Prerequisites: General chemistry

Course Objectives

- **Classification** and **applications** of abrasives and adhesives
- **Familiarity** of the types and applications of refractories and ceramics
- **Examining** the properties of lubricants and learning the mechanism of lubrication
- **Knowledge** of manufacturing of cement and its properties
- **Listing** out various types of fuels and understanding the concept of calorific values

Course Outcomes

After completion of the course the student is able to

- **Formulate** and **infer** the suitability of abrasives and adhesives in different industries
- **Understand** benefits of refractories and ceramics as heat resistant materials in industries
- **Assess** the quality of lubricants and their appropriate usage in machinery
- **Interpret** the setting and hardening process of cement
- **Acquire** the knowledge of efficiency of fuels and identify a better fuel source of less pollution.

UNIT I

ENGINEERING MATERIALS

Abrasives: Introduction, classification and applications of natural abrasives (diamond, quartz) and synthetic abrasives (silicon carbide, boron nitride).

Adhesives: Criteria of a good adhesive, classification and applications of thermoplastic adhesives (cellulose and acrylics) and thermosetting adhesives (phenol formaldehyde and epoxy resins).

UNIT II

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 and porosity.

Ceramics: Introduction, classification- whiteware, stoneware, earthenware and their applications, Glazing- definition and liquid glazing.

UNIT III

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; Properties of lubricants –definition and Significance of viscosity, cloud point, pour point, flash & fire point, mechanical stability, oiliness, and carbon residue.

Biodegradable lubricants: classification, advantages and disadvantages of biodegradable lubricants.

UNIT IV

Cement: Types of cement, chemical constituents and composition of Portland cement and manufacturing methods of Portland cement (wet and dry processes). Setting and hardening of cement (reactions); decay of cement; cement concrete - RCC.

UNIT V

Energy Sources: Fuels - classification (solid, liquid, gaseous), calorific value of fuel (HCV, LCV), Dulong formula- numericals, Solid fuels – coal – proximate and ultimate analysis and their significance (no numerical problems), Liquid fuels – petrol – cracking, need for cracking, types of cracking(thermal and catalytic cracking), fluid bed catalytic cracking, synthetic petrol by Fischer- Tropsch's process. Knocking- octane number, cetane number. Gaseous fuels - natural gas, LPG, CNG (composition and uses).

Biofuels - Characteristics, biodiesel - transesterification, properties and applications.

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.

REFERENCES

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Year I Semester **L T/PD C**
3 1 4

(5IT01) C PROGRAMMING AND DATA STRUCTURES

(Common to CE, ME & AE)

Course Prerequisites: Knowledge on Computers and Mathematics.

Course Objectives

- **Discuss** the history of computers and fundamentals of problem solving using structured programming
- **Identify** the appropriate decision making and branching statements to solve the problem
- **Understand** different derived data types
- **Identify** basic and advanced sorting and searching techniques and understand the operations of linear data structures

Course Outcomes

After completion of the course the student is able to

- **Apply** knowledge of mathematics, science engineering and technology in problems solving using C programming Language
- **Analyze** structured programming methods, techniques and standard library functions
- **Understand** and relate different derived data types and able to choose the loops and decision making statements to solve the given problem
- **Identify** trade-offs involved in choosing static versus dynamic data structures and also implementation of stacks, queues and linked lists and different searching and sorting techniques for a given application

UNIT I

Introduction to Computers - Computer systems, computing environments, computer languages, creating and running programs and 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 and Insertion sort.

Introduction to data structures, Dynamic memory allocation, stacks and queues- implementation using arrays.

TEXT BOOKS

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Year I Semester

L	T/P/D	C
3	1	4

(5CE01) ENGINEERING MECHANICS – I

(Common to CE, ME & AE)

Course Prerequisites: Physics, Mathematics

Course Objectives

- **Understand** and analyse the forces and reactions for equilibrium
- **Discuss** various types of friction, laws of friction and analyse body/bodies lying on rough planes
- **Distinguish** between centroid, centre of mass and centre of gravity
- **Understand** the concept of area moment of inertia and mass moment of inertia about any axes

Course Outcomes

After completion of the course the student is able to

- **Determine** the resultant of coplanar concurrent and non-concurrent force systems and analyse the bodies for equilibrium to find the unknown forces
- **Analyze** the bodies on rough horizontal and inclined planes and connected bodies
- **Determine** the centroid of composite areas, centre of gravity of composite bodies
- **Determine** the moment of inertia of simple areas and mass MI of simple bodies

UNIT I

Forces: Introduction to Engineering Mechanics – Basic Concepts - Classification of a force system - Parallelogram law of forces - Triangle law of forces - Polygon law of forces – law of transmissibility of forces – Principle of superposition - Lami's theorem - Free Body Diagram – Resultant – Equilibrant - Resultant of coplanar concurrent forces - Equilibrium of coplanar concurrent forces.

UNIT II

Moments: Moment of a 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 –Types of supports - Support reactions.

UNIT III

Friction: Types of Friction - Limiting Friction - Laws of 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 - Centre of mass of simple bodies - Centre of gravity of simple bodies - Centre of gravity of composite bodies - Pappu's theorems.

UNIT V

Area moment of Inertia: Introduction- Inertia - Inertia of areas - Rotation of areas - Radius of gyration - Polar moment of inertia - Parallel axis theorem - Perpendicular axis theorem - Moments of inertia of simple figures and composite figures.

Mass Moment of Inertia: Moment of inertia of Masses – Significance - Rotation of mass - Mass moment of inertia of simple bodies.

TEXT BOOKS

1. Engineering Mechanics by S.Timoshenko, D.H.Young & J.V.Rao, Tata McGraw Hill Publishers, 4th Edition, 2010.
2. Singer's Engineering Mechanics by K. Vijaya Kumar Reddy & J. Suresh kumar , B.S Publishers,3rd Edition,2011.

REFERENCES

1. Engineering Mechanics by S.S. Bhavikatti, Newage International Publishers, 2012.
2. Engineering Mechanics (Statics) by J.L.Meriam & L.G.Kraige, Wiley Publishers, 6th Edition, 2006.
3. Engineering Mechanics by A.K.Tayal, Umesh Publications, 13th Edition, 2010.
4. Engineering Mechanics by R.K. Rajput, laxmi Publications, 1998.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Year I Semester

L	T/P/D	C
0	6	3

(5ME51) ENGINEERING GRAPHICS – I

(Common to ME & AE)

Course Prerequisites: Geometrical constructions

Course Objectives

- **Remember** the conventions of Engineering Drawing and Auto Cad software commands and know the importance of engineering scales and engineering curves
- **Know** the importance of orthographic projections and orientations of points, lines, planes and its traces
- **Understand** the importance of positions of planes and its auxiliary views
- **Understand** the importance of positions of solids and its auxiliary views

Course Outcomes

After completion of the course the student is able to

- **Interpret** the concepts of scales and curves and Solve the problems as per the drawing conventions by using Auto CAD
- **Solve** the problems on Projections of points, lines and their traces by using Auto CAD
- **Solve** the problems on positions of planes and the auxiliary views by using Auto CAD
- **Apply** the knowledge of orientations of solids and solve the problems on solids and its auxiliary views by using Auto CAD

UNIT I

Introduction to Auto CAD

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 Straight 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. Bhat; Charotar Publishing House.
2. Engineering Drawing by K.L. Narayana and P. Kannaiah; Scitech Publications.

REFERENCE

1. Engineering Graphics for degree by K.C. John; Publisher: Prentice Hall of India.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Year I Semester **L T/P/D C**
0 3 2

(5BS25) ENGINEERING PHYSICS AND CHEMISTRY LABORATORY

(Common to CE, EEE, ME, ECE, CSE, EIE, IT & AE)

ENGINEERING PHYSICS LABORATORY

Course Objectives

- Practically **learn** interaction of light with matter through physical phenomena like interference, diffraction and dispersion.
- **Understand** the periodic motion and formation of standing waves and to know the characteristics of the capacitors and resistors.
- **Compare** the experimental results with the class room learning.

Course Outcomes

After completion of the course the student is able to

- **Demonstrate** the optical phenomena with formation of Newton Rings, and formation of spectra with a grating and a prism
- **Illustrate** periodic motion by measuring rigidity modulus of a material and formation of standing waves by Melde's apparatus and also discharging of a capacitor
- **Correlate** the experimental results with the class room learning

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

REFERENCES

1. Essential Practical Lab Manual in Physics: by Dr.P.Raghavendra Rao,P.Pavankumar and B.Ashok (inhouse document)
2. Engineering Physics Practicals by B.Srinivasa Rao, V.K.V.Krishna and K.S.Rudramamba, University Science Press, New Delhi

ENGINEERING CHEMISTRY LABORATORY

Pre-requisites: Basic knowledge of Volumetric Analysis and Mathematics.

Course Objectives

- Familiarize the preparation of solutions and operation of instruments
- Conduct of experiment, collection and analyzing the data
- Summarizing the data and find the applicability of the experiment to common society

Course Outcomes

- Understanding the preparation of standard solutions and handling of instruments
- Knowledge of experimentation and recording the data
- Interpretation of results to real world scenario

LIST OF EXPERIMENTS

1. **Titrimetry:** Estimation of hardness of water by EDTA method.
2. **Conductometry:** Conductometric titration of acid vs base.
3. **Colorimetry:** Estimation of copper by colorimetric method.
4. **pH metry:** Determination of pH of sample solutions.
5. Determination of viscosity of sample oil by Redwood Viscometer.
6. **Preparations:** Soap and Nanoparticles.

TEXT BOOKS:

1. Laboratory Manual on Engineering Chemistry by S.K.Bhasin and Sudha Rani; Publisher: Dhanpat Rai.
2. Laboratory Manual on Engineering Chemistry by Y.Bharathi Kumari and Jyotsna Cherukuri; Publisher: VGS Book Links.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Year I Semester **L T/P/D C**
0 3 2

(5IT51) C PROGRAMMING AND DATA STRUCTURES LABORATORY

(Common to CE, ME & AE)

Course Objectives

- **Understand** the basic structure of C programming
- **List** different decision making and branching statements and their usage in analyzing problems
- **Understand** the usage of derived data types to solve the problems
- **Apply** different searching and sorting methods and implement linear data structures

Course Outcomes

After completion of the course the student is able to

- **Apply** mathematics, science, engineering and technology in problem solving using C programming language
- **Design** c programs using different c tokens
- **Experiment** appropriate decision making statements and derived data types to solve a given problem
- **Analyze** and implement linear data structures, and differentiate the various searching and sorting techniques

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 to 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 have 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 have 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

TEXT BOOKS

1. Computer science, A structured programming approach using C, B.A. Forouzan and R.F. Gilberg, Third edition, Thomson.
2. C Programming and Data 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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B.Tech. I Year II Semester

L	T/P/D	C
3	0	3

(5CE03) ENVIRONMENTAL STUDIES

(Common to CE, EEE, ME, ECE, CSE, EIE, IT & AE)

Course Objectives

- **Recognize** the importance of environment and ecosystem
- **Identify & Analyze** human activities and its impact on environment.
- **List and understand** about the importance of natural resources, Biodiversity & effect of environment pollution
- **Understand** about environmental regulations ,economy and environment interaction

Course Outcomes

Students should be able to

- **Acquire** the knowledge about importance of environment & ecosystem
- **Develop** skills in understanding of various environmental problems
- **Find** the solution and strategies to protect the Environment
- **List & Distinguish** various organizations, regulations for environment protection

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 Ecosystem.

Bio-diversity and its Conservation- Value of bio-diversity, 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 – In-situ and Ex-situ conservation.

UNIT II

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

Mining and Dams: Benefits and effects, 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

Environmental Pollution and its Control: Classification of pollution and pollutants, Air pollution, Causes, Effects, Control measures, ambient air quality standards, water pollution causes, effects, control measures, water quality standards, Marine pollution causes, effects & control measures, noise pollution causes, effects and control measures, land pollution causes, effects and control measures, solid waste management, e-waste management.

UNIT IV

Global environmental problems and global efforts: Nuclear hazards, Nuclear Pollution, Global warming, Acid rains, ozone layer depletion, over population, hazardous waste. Clean development mechanism, green building, carbon credits, carbon trading.

International Conventions/protocols: UNEP, UNFCC, Earth summit, Kyoto protocol, Montreal protocol and Stockholm declaration.

UNIT V

Environmental policy, legislation, rules and regulations : National Environmental Policy Environmental Protection act, Legal aspects Air (Prevention anc Control of pollution) Act-1981, Water(Prevention and Control of pollution) Act-1974, Water pollution Cess Act-1977, Forest Conservation Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules .

Economy and Environment, The economy and environment interaction, Economics of development, preservation and Conservation, Sustainability: theory and practices.

Environmental Impact Assessment, Rain water harvesting, cloud seeding and watershed management.

TEXT BOOKS

1. Environmental Science - Y.Anjaneyulu, B S Publications.
2. Environmental studies - Deeksha dave, Cengage learning India Pvt. Ltd.
3. Environmental Science and Technology by M. Anji Reddy, B S Publications.

REFERENCES

1. Environmental Studies for UG Courses, Bharucha Erach, UGC Publications, Delhi, 2004.
2. Environmental Encyclopedia by Cunningham, W.P., et al., Jaico Publishing House, Mumbai, 2003.
3. Environmental sciences and Engineering by P.Venugopal Rao, PHI Learning Pvt. Ltd.

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3	0	3

(5BS12) ORDINARY DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

(Common to CE, EEE, ME, ECE, CSE, EIE, IT & AE)

Course prerequisites: Differentiation and Integration

Course Objectives

- **Understand** the methods of solving first order differential equations and learn about its applications to basic engineering problems
- **Understand** the methods of solving higher order differential equations and learn about its applications to basic engineering problems
- **Understand** the method of series solutions of second order ordinary differential equations
- **Apply** the convolution theorem to evaluate inverse Laplace Transform of the functions

Course Outcomes

After completion of the course the student is able to

- Solve the problems in first order differential equations.
- Solve the problems in second order differential equations
- Obtain the series solutions of second order ordinary differential equations
- Learn Laplace Transform as a tool

UNIT I

Ordinary Differential Equations of First Order 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 II

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

UNIT III

Differential Equations with Variable Coefficients:

Euler-Cauchy's 2nd order differential equations, Series solutions of second order Ordinary Differential Equations, Regular point, Regular singular point, Frobineous Method.

UNIT IV

Laplace Transforms:

Existence condition, Laplace transform of Elementary functions, Properties of Laplace transforms, Laplace transform of special functions (Unit step function, Dirac delta function and Periodic function).

UNIT V

Inverse Laplace Transforms:

Inverse Laplace transform of functions using partial fractions, Convolution theorem (statement only). Solving linear differential equations and Integro-differential eqations using Laplace transform.

TEXT BOOKS

1. Higher Engineering Mathematics – B. S. Grewal,Khanna publishers.
2. 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.
3. A First Course in Differential Equations by Dennis G. Zill; Publisher: Brooks Cole publiers.

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B.Tech. I Year II Semester **L T/P/D C**
3 0 3

(5BS22) PHYSICS OF MATERIALS

(Common to ME & AE)

Course Prerequisites: General Physics

Course Objectives

- **Learn** basic structures and classifications of solids
- **Study** various dielectric, magnetic and size dependent properties of materials
- **Visualise** different kinds of materials in engineering and technology

Course Outcomes

After completion of the course the student is able to

- **Identify** different types of crystals, their defects and importance of X-ray studies in crystals
- **Recognize** materials' magnetic, dielectric and size dependent behavior
- **Showcase** some applications of crystals and different kinds of materials in engineering

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 Ltd.
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.

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B.Tech. I Year II Semester

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(5BS32) ENGINEERING CHEMISTRY

(Common to CE, EEE, ME, ECE, CSE, EIE, IT & AE)

Course Prerequisites: Basic knowledge of mathematics and chemistry

Course Objectives

- **Understanding** the concept of generating electricity by batteries
- **Conceptual** knowledge of corrosion science
- **Acquiring** the knowledge of preparation, properties and usage of polymers.
- **Applying** the concept of hardness to analyze various boiler troubles in steam generation
- **Familiarize** the features of carbon nanotubes, composites and self- healing materials

Course Outcomes

After completion of the course the student is able to

- **Interpret** the chemical applications of the various types of batteries used in the present day world
- **Acquire** the knowledge of corrosion for protecting structures and safeguarding the economy
- **Evaluate** the suitability of various polymers for different applications
- **Analyze** and compare the different softening techniques of water
- **Summarize** the applications of carbon nanotubes, composites and self- healing materials

UNIT I

Batteries and Fuel Cells: Electrochemistry-definition, types of cells- differences between electrolytic and electrochemical cells, conditions of reversibility, principle of batteries, Primary cells-(Dry cell, Mercury battery) and secondary cells -lead-acid cell; Ni-Cd cell; lithium- ion cells (intercalated); Fuel cells : methanol – oxygen fuel cell, advantages of fuel cells; Solar cells - principle and applications.

UNIT II

Corrosion and its Control: Introduction; Causes and effects of corrosion; Theories of corrosion – chemical and electrochemical corrosion (reactions); Types of corrosion (Differential aeration corrosion: pitting, crevice and waterline corrosion, Differential metal corrosion: galvanic corrosion) ; Factors affecting corrosion – nature of metal (position of metal in galvanic series-differences between electrochemical & galvanic series; passivity; purity of

metal; nature of oxide film; nature of corrosion product), and nature of environment (effect of temperature; effect of pH; humidity; formation of oxygen concentration cells).

Corrosion control methods – cathodic protection-sacrificial anode and impressed current cathodic protection.

Surface coatings –differences between galvanizing and tinning; cladding; electroplating (copper plating), Paints - constituents and functions.

UNIT III

Polymers

Plastics: Thermoplastic resins, and Thermosetting resins, fabrication of plastics – compression, injection. Preparation, properties, and engineering applications of PE, PVC, Teflon, Bakelite, Nylon and Kevlar.

Rubber: Processing and vulcanization, preparation, properties, and engineering applications of Buna-S; Butyl rubber and Thiokol rubber.

UNIT IV

Water and its Treatment: Introduction; Hardness - causes, expression of hardness, units, types of hardness, numerical problems. Estimation of temporary & permanent hardness of water by EDTA method (no numerical problems). Boiler troubles - scale & sludge formation, caustic embrittlement, boiler corrosion, priming & foaming. Softening of water by zeolite and ion exchange process (no numerical problems), Desalination processes - reverse osmosis.

UNIT V

Smart materials

Nanomaterials: Introduction; preparation and applications of nanomaterials with special reference to carbon nanotubes.

Composites: Need for composites, classification based on reinforcing material (Fiber reinforced composites –glass, carbon and aramid), applications of composites.

Self-healing materials: Definition, features, principle of self-healing materials and their applications.

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; McGraw Hill Edu.Pvt.Ltd.
3. Text Book of Engineering Chemistry by R.Gopalan, D.Venkappayya, Sulochana Nagarajan; Publisher: Vikas Publishers.
4. Engineering Chemistry by R.P.Mani, S.N. Mishra, B.Rama Devi, Cengage Learning Publications.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. I Year II Semester **L T/P/D C**
3 0 3

(5BS01) ENGLISH

(Common to CE, EEE, ME, ECE, CSE, EIE, IT & AE)

Course Prerequisites: General 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 and also develop their reading skills.

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

Course Objectives:

- To equip the students with all the LSRW skills for academic writing and speaking.
- To equip the students with basic grammar, infrastructural patterns, reading techniques and grammatical constructions required in technical writing as well as oral communication.
- To acquaint the students with the writing process in preparation for academic and workplace writing.
- Equip the students with the concept of coherence and cohesion for meaningful and coherent communication.

Course Outcomes:

After going through this course the student 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
- Students communicate coherently orally and in writing.

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

Unit II : Prose 1

- Heaven's Gate by Pico Iyer
- The Connoisseur by Nergis Dalal

Unit III Reading and Writing Skills

- Reading Comprehension -- Skimming & scanning
- Reading Comprehension -- Intensive & extensive reading
- Paragraph Writing
- Letter Writing
- Memo Writing

Unit IV : Prose 2

- The Cuddalore Experience by Anu George
- The Odds Against Us by Satyajit Ray

Unit V : Writing Skills

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

Prescribed Text Books

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

References

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

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B.Tech. I Year II Semester

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3	1	4

(5CE02) ENGINEERING MECHANICS – II

(Common to CE, ME & AE)

Course Prerequisite: Physics, Mathematics, Engineering Mechanics – I

Course Objectives

- **Understand** the assumptions in the analysis of trusses and list the types of trusses
- **Understand** the principle of virtual work and its applications
- **Distinguish** between statics and dynamics & kinematics and kinetics
- **Understand** the work-energy principle and impulse-momentum principle

Course Outcomes

After completion of the course the student is able to

- **Determine** the member forces in trusses using method of joints and method of sections
- **Apply** virtual work principle to beams, ladder and rod problems to determine the unknown forces
- **Solve** the kinematics and kinetics problems
- **Apply** work-energy principle to solve the rigid body problems

UNIT I

Trusses: Types of frames – Analysis of pin jointed frames – Assumptions - 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.

UNIT II

Virtual Work: Concept of virtual work - Principle of virtual work - Application of principle of virtual work to beams - ladders and framed structures.

UNIT III

Kinematics: Kinematics of particles – Kinematics of Rectilinear motion – Kinematics of Curvilinear motion – Projectiles – Kinematics of rigid bodies about a fixed axis.

UNIT IV

Kinetics: Kinetics of particles – Newton's Second Law – Differential equations of rectilinear and curvilinear motion – Dynamic equilibrium – Inertia force - D' Alembert's Principle applied for rectilinear and curvilinear motion - Kinetics of rigid bodies.

UNIT V

Work - Energy, Impulse - Momentum: Work of a force - Principle of Work and Energy - Application of principle of Work-Energy - Impulse-Momentum Principle, Application of Impulse - Momentum principle to connected bodies.

TEXT BOOKS

1. Engineering Mechanics by Timoshenko and Young, Tata Mc-Graw Hill Publishers.
2. Singer's Engineering Mechanics by K. Vijaya Kumar Reddy, BS Publishers.
3. Engineering Mechanics by S.S. Bhavikatti, New age International Publishers.

REFERENCES

1. Engineering Mechanics (Dynamics) by Meriam & Kraige
2. Engineering Mechanics by Tayal
3. Engineering Mechanics by R.K. Rajput

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B.Tech. I Year II Semester

L	T/P/D	C
0	6	3

(5ME52) ENGINEERING GRAPHICS – II

(Common to ME & AE)

Course Prerequisites: Engineering Graphics -I

Course Objectives

- **Learn** the concepts of section of solids, development of surfaces
- **Understand** and remember the intersection of various solids
- **Know** the various types of projections- orthographic to isometric and vice-versa
- **Understand** and remember the principles of perspective projections

Course Outcomes

After completion of the course the student is able to

- Apply the concepts of sections and solve the problems on attaining true shape of section and obtain the development of surfaces of various solids using AutoCAD
- Solve the problems on intersection of solids like prism vs prism, cylinder vs cylinder and cylinder vs cone, using AutoCAD
- Apply the concepts of isometric projections and solve the problems in Auto CAD
- Apply the concepts of perspective projections and solve the problems in Auto CAD

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.

REFERENCE

1. Engineering Graphics for degree by K.C. John; Publisher: Prentice Hall of India.

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L	T/P/D	C
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(5ME53) IT AND ENGINEERING WORKSHOP

(Common to CE, EEE, ME, ECE, CSE, EIE, IT & AE)

Course Prerequisites: Basic knowledge about different Trades, computer hardware, Operating System, different trades in mechanical engineering.

Course Objectives

- To study/demonstrate the concepts of computer w.r.t. it's hardware.
- To install the operating system and perform various tasks
- 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

After completion of the course the student is able to

- Identify, assemble and dissemble the given configuration of a computer.
- Install the operating system in the given configuration of a computer and execute commands for LINUX Operating System
- 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. Study of UPS and SMPS
3. Assembling and disassembling of a PC
4. Simple diagnostic exercises – Related to hardware
5. Installation of Windows Operating System
6. Installation of Linux Operating System
7. Linux Basic Commands
8. 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 – CISCO 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
4. 3D Printing

TEXT BOOK

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

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0 3 2

(5BS02) ENGLISH LANGUAGE COMMUNICATION SKILLS LABORATORY

(Common to CE, EEE, ME, ECE, CSE, EIE, IT & AE)

Course Prerequisites: General English

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 and train the students in oral presentations, public speaking, role play and situational dialogue.
- Provide practice in word usage, grammatical construction, structural patterns, 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.

Course Outcomes

After going through this course the student will be able to

- 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 oneself to people and be able to speak extempore.

Syllabus for Lab Sessions

Unit 1

Computer Aided Language Lab:

- Grammar : Nouns and Pronouns; Articles; The Present Tense
- Vocabulary: Lesson 1
- Listening Comprehension

Communication Skills Lab: Introduction of Self and others

Unit 2

Computer Aided Language 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
Computer Aided Language Lab:
Grammar --- Adverbs, Conjunctions, Prepositions; The Future Tense
- Vocabulary: Lesson 3
- Telephoning Skills

Communication Skills Lab: Role Play/ Situational Dialogues

Unit 4
Computer Aided Language Lab:
1. Grammar ---- Active and Passive Voice
2.Vocabulary: Lesson 4
3. Listening Comprehension

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

Unit 5
Computer Aided Language 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
Computer Aided Language Lab Requirements:

The English Language Lab shall have two parts:

i) The Computer aided Language Lab for 30 students with 30 systems, one master console, LAN facility and English language software for self- study by learners.

ii) The Communication Skills Lab with conference tables and movable chairs for 30 students and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and a camcorder

- **System Requirement (Hardware component):**
  Computer network with Lan with 30 multimedia systems with the following specifications:
  - P – IV Processor
  - Speed – 2.8 GHZ
  - RAM – 512 MB Minimum
  - Hard Disk – 80 GB
  - Headphones of High quality

iv) Suggested Resources:
Software consisting of the prescribed topics elaborated above may be procured and used. Additionally, the abundantly available online resources may also be used.

List of suggested software:
- **Tense Busters (5 Levels)**
- **Walden Educare**

- **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 AND TECHNOLOGY

B.Tech. II Year I Semester

L	T/P/D	C
3	0	3

(5BS14) PARTIAL DIFFERENTIAL EQUATIONS WITH APPLICATIONS AND COMPLEX ANALYSIS

(Common to EEE, ME & AE)

Course prerequisites: Differentiation, integration

Course Objectives:

- Compute Fourier coefficients.
- Understand the properties of Fourier transforms.
- Apply Method of Separation of Variables to solve Partial Differential Equations.
- Apply Cauchy theorem, Cauchy's Integral formula and Residue theorem to evaluate complex integration.

Course Outcomes:

After completion of the course the student is able to:

- Solve problems using Fourier series.
- Evaluate problems involving Fourier and Inverse Fourier transforms.
- Solve the second order linear partial differential equations by Method of Separation of Variables and Fourier series.
- Evaluate line and Contour integrals.

UNITI

Standard Partial Differential Equations: Introduction to 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 II

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 III

Fourier Transforms: Fourier transform, Sine and Cosine transforms and their properties.

UNITIV

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.

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Year I Semester

L	T/P/D	C
3	0	3

(5ME01) MECHANICS OF SOLIDS

(Common to ME & AE)

Course Prerequisites: Maths, Physics and Engineering Mechanics

Course Objectives

- **List** and define the material properties and show the relationships between them.
- **Describe** principles of mechanics, stress and strain
- **Demonstrate** thoroughly the concepts of principal stresses applied to solid structural members and mohr's circle diagram
- **Analyse** various types of mechanical engineering problems concern to bending of beams, torsion of shafts etc.

Course Outcomes

After completion of the course the student is able to

- **Show** basic stress strain equations with appropriate assumptions
- **Interpret** model and analyze solid mechanics problems on bars,beams and shafts
- **Apply** the concepts of principal stresses in real life design issues
- **Analyse** 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

3. Mechanics of Materials (SI units) by J.M.Gere and S.P.Timoshenko; Publisher: CBS Publishers.
4. Strength of Materials by S. S. Rattan, Publisher: Tata McGraw-Hill Education.

REFERENCES

1. Engineering Mechanics of Solids by Popov; Publisher: Pearson Education.
2. Strength of Materials Schaum's Series.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(5ME02) THERMODYNAMICS

(Common to ME & AE)

Course Prerequisites: Physics

Course Objectives

- **Apply** the basic concepts of thermodynamics and Thermodynamic Laws for various thermodynamic systems
- **Evaluate** the properties of pure substance and to analyse the concept of irreversibility and availability
- **Apply** the basic concept of power cycles for External combustion engines and internal combustion engines
- **Evaluate** the behaviour of ideal gas mixtures and Thermodynamic properties

Course Outcomes

After completion of the course the student is able to

- **Apply** the basic concepts of thermodynamics and Thermodynamic Laws for various thermodynamic systems
- **Evaluate** the properties of pure substance and to analyse the concept of irreversibility and availability
- **Apply** the basic concept of power cycles for External combustion engines and internal combustion engines
- **Evaluate** the behaviour of ideal gas mixtures and Thermodynamic properties of the given mixture of gases

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; Available energy Referred to a cycle; Quality of energy; Maximum work in a reversible process; reversible work by an open system; Exchanging heat only with the surroundings; Useful work; Dead state; Availability; Availability in chemical reaction; Irreversibility and Gouy-stodola Theorem; Availability or Exergy Balance; second law efficiency.

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: Ideal Gas;Real Gas; Internal Energy and Enthalpy of an Ideal Gas; Specific Heats of an ideal gas; Equations of state; Virial Expansions; Law of Corresponding states; Boyle Temperature; Dalton's Law of Partial Pressures; Thermodynamic Properties of Gas Mixtures; Gibbs Function of Ideal Gas Mixtures.

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.

TEXT BOOKS

1. Engineering Thermodynamics by P.K. Nag, Publisher: McGraw-Hill.
2. Engineering Thermodynamics by P.Chattopadhyay, Oxford University Press.

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Year I Semester **L T/P/D C**
3 0 3

(5ME03) METALLURGY AND MATERIAL SCIENCE

(Common to ME & AE)

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
- **Able** to understand the importance of Titanium & its alloys

Course Outcomes

After completion of the course the student is 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.
- **Explain** & **justify** the usage of Titanium & its 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 – stellites, 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 BOOKS

1. Introduction to Physical Metallurgy by Sidney H. Avner; Publisher: McGraw-Hill.
2. Materials Science and Metallurgy by Kodigiri, publisher: Everest.

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Year I Semester **L T/P/D C**
3 0 3

(5ME04) FLUID MECHANICS AND HYDRAULIC MACHINES

(Common to ME & AE)

Course Prerequisites: Maths, Physics and Engineering Mechanics

Course Objectives

- **Understand** the properties of fluids, principles of buoyancy, flow, force and head calculations
- **Evaluation** of types of fluid flow, Laminar and dynamic
- **Knowledge** on boundary layer principles applied to aerofoiles
- **Principles** of operation of different types of hydraulic machinery

Course Outcomes

After completion of the course the student is able to

- **Analyzing** the fluid properties to solve flow, force and velocity problems
- **Evaluating** the flow characterizing in static and dynamic nature of flow
- **Applying** fluid flow and dynamics in solving problems in hydraulic machines
- **Understanding** the 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 BOOKS

1. Hydraulics and Fluid Mechanics Including Hydraulics Machines: Dr. P.N.Modi, Dr. S.M. Seth.
2. Introduction to Fluid Mechanics, R. W. Fox, A. T. McDonald and P.J Pritchard.

REFERENCES

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. Fundamentals of Fluid Mechanics: Bruce Roy Munson, Donald F. Young, Theodore H. Okiishi, Wade W. Huebsch Wiley Publication.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(5ME54) METALLURGY AND MATERIAL SCIENCE LABORATORY

(Common to ME & AE)

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
- **Understand** the microstructure of cutting tool

Course Outcomes

After completion of the course the student is 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
- **Examine** the microstructure of cutting tool

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. Hardenability 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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Year I Semester

L	T/P/D	C
0	3	2

(5ME55) MECHANICS OF SOLIDS LABORATORY

(Common to ME & AE)

Course Prerequisites: Mechanics of solids, Engineering Mechanics

Course Objectives

- **Analyze** the various tests to be conducted on engineering materials
- The **significance** of tests in evaluating the corresponding mechanical properties
- **Analyze** the importance of technical parameters used during tests
- **Applying** the concepts learned in the real time

Course Outcomes

After completion of the course the student is able to

- **Apply** the theoretical concepts by conducting the tests on different materials
- **Evaluate** the result of test and comment on the mechanical properties of materials
- **Decide** a material and an appropriate test suitable for given application
- **Analyze** 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) Brinell 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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(5ME56) FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY

(Common to ME & AE)

Course Prerequisites: Fluid Mechanics and Hydraulic Machines

Course Objectives

- **Analyzing** 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
- **Analyzing** various pumps, water turbines, pipes and pressure measurement devices
- **Evaluating** efficiency for pumps and turbines

Course Outcomes

After completion of the course the student is able to

- **Apply** fundamental equations of fluid mechanics for turbines and pumps
- **Model** and analyse fluid flow problems in mechanical engineering
- **Create** a model of fluid flow equipments
- **Evaluate** 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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Year II Semester

L	T/P/D	C
3	0	3

(5BS13) COMPUTATIONAL METHODS

(Common to CE, EEE, ME, ECE, CSE, EIE, IT & AE)

Course Prerequisites: Elementary transformations of matrices, differentiation and integration.

Course Objectives

- Understand the numerical methods for non linear systems, evaluating definite integrals and solving Ordinary Differential Equations.
- Understand various methods of interpolation and application.
- Understand the Echolen form and Normal form of a matrix and its applications in solving linear system of equations.
- Solving system of linear equations using Jacobi and Gauss-Seidal methods.

Course Outcomes

After completion of the course the student is 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.
- Find the rank using Echelon form, Normal form and compute eigen values.
- Solve linear equations using Jacobi method and Gauss-Seidal method

UNIT I

Solutions of non-linear systems: Introduction; Mathematical preliminaries; Solution of algebraic and transcendental equations –bisection method, the method of false position, Fixed point iterative method , 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 and Lagrange's 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, Gaussian quadrature 2 & 3 point formulae.

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.

UNIT IV

Matrices: Elementary Transformations, Rank of matrix, Echelon and Normal forms, Consistency of linear simultaneous equations, Eigen values and eigen vectors and their properties, Caley – Hamilton theorem (without proof), Quadratic forms - reduction of quadratic form to canonical form by linear(congruent) and orthogonal transformations.

UNIT V

Complex Matrices and Iterative Methods for Real Systems: Unitary, Hermitian and skew – Hermitian matrices. Iterative methods for solving a system of linear equations (Jacobi method, Gauss-Seidal algorithm) and Power method to find largest and smallest eigen values.

TEXT BOOKS

1. Numerical Methods in Engineering and Science–B.S. Grewal, 3rdedition Publisher: Khanna Publishers.
2. 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 and Sons.
2. Elementary Numerical Analysis – an algorithmic approach -Samuel D. Conte and Carl De Boor (2006); 3rd edition; Publisher: Tata McGraw Hill

(Beyond Syllabus: Types of errors and analysis)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Year II Semester **L T/P/D C**
3 1 4

(5AE01) APPLIED THERMODYNAMICS

Course Prerequisites: Mathematics and Thermodynamics

Course Objectives

- **Understand** the first and second laws of thermodynamics
- **Extend** the application of thermodynamic principles to evaluate the performance parameters of various systems
- **Use** mathematical skills to analyse thermodynamic systems
- **Design** of various thermodynamic systems

Course Outcomes

After completion of the course the student is able to

- **Apply** first and second laws of thermodynamics to various systems
- **Evaluate** the performance parameters of different thermodynamic systems
- **Identify** and analyse sub-systems of thermodynamic systems
- **Design** and synthesize the study flow thermodynamic systems

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 and equivalent evaporation.

Steam Condensers: Introduction, purpose and types of condenser, efficiency of condenser and Edward air pump.

UNIT II

Steam Nozzles: Functions of nozzle, applications, types, flow through nozzles, thermodynamic analysis, assumptions, velocity of nozzle at exit, ideal and actual expansion in nozzle, velocity co-efficient, condition for maximum discharge and critical pressure ratio.

Steam Turbines: Classification, impulse turbine, mechanical details, velocity diagram, effect of friction, power developed, axial thrust, diagram efficiency, condition for maximum efficiency and methods to reduce rotor speed.

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

UNIT III

Compressors: Classification, power producing and power absorbing machines, fan, blower and compressor, roots blower, vane blower, sealed compressor and Lysholm compressor – working principle.

Reciprocating Compressors: Principle of operation, work required, isothermal efficiency, volumetric efficiency and effect of clearance, multi stage compression, under cooling, saving of work and minimum work condition for stage compression.

UNIT IV

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, adiabatic co-efficient, velocity diagrams and power requirement to run the compressor.

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 and polytrophic efficiency

UNIT V

Gas Turbines: Classification of gas turbine plants, ideal cycle, essential components, parameters of performance, actual cycle, regeneration, inter cooling and reheating.

Jet Propulsion and Rockets: Classification of Jet propulsion engines, principle of operation, working principles with schematic diagram and representation on T- s diagram. Needs and demands met by turbo jet engines, rockets, application, working principle, classification and propellant type.

TEXT BOOKS

3. Rathod, Thermal Engineering, TMH Publications, 2012.
4. Ganesan V, Gas Turbines, TMH Publications, 2010.

REFERENCES

1. Rajput R K, Thermal Engineering, Laxmi Publications, 2010.
2. Mathur and Sharma, I.C. Engines, Dhanpath Rai & Sons, 2010.
3. Yadav R, Thermodynamics and Heat Engines, Central Book Depot, 2002.
4. Ballaney P L, Thermal Engineering, Khanna Publishers, 2010.
5. Khajuria P and Dubey S P, Gas Turbines and Propulsive systems, Dhanpat Rai & Sons, 2012.

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VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Year II Semester **L T/P/D C**
3 0 3

(5AE02) AUTOMOTIVE ENGINES AND SYSTEMS

Course Prerequisites: Thermodynamics, Basic Electrical Engineering

Course Objectives

- **Understand** the fundamentals, principles and functions of an automotive engine and sub-systems
- **Present** the constructional features of internal combustion engines
- **Discuss** testing and performance characteristics of an engine
- **Identify** engine emissions and regulations

Course Outcomes

After completion of the course the student is able to

- **Know** the fundamental concepts and functions of an automotive engine and sub-systems
- **Describe** the constructional features of internal combustion engines
- **Analyze** testing and performance characteristics of an engine
- **Summarize** engine emissions and regulations

UNIT I

Introduction: Classification and components of an engine, principle and working of four stoke and two stroke SI and CI engines. Comparison of theoretical and actual cycles and their analysis. Wankel rotary engine.

Engine Construction: Cylinder head, cylinder block, crank case, sump, cooling passages, cylinder liners, piston types, piston rings, connecting rods, crank shafts, valves, valve seat inserts, valve actuating mechanisms and drive mechanisms.

UNIT II

Combustion and Combustion Chambers: Petrol engines - Ignition limits, stages of combustion, effect of engine variables, knocking and detonation - theory, parameters affecting and control, combustion chamber - different types and design. Diesel engines – Air/Fuel ratio, stages of combustion, knocking and detonation - theory, parameters affecting and control, combustion chamber - different types.

Fuel Feed Systems: Carburetor, Air/Fuel mixture proportions, cold start, idle, normal running and acceleration and transfer circuits. Diesel fuel injection pump, construction and working principles. Governing systems, types of fuel injectors and nozzles, Introduction to electronic fuel injection system.

UNIT III

Cooling and Lubrication Systems: Engine heat transfer, engine energy balance, necessity of cooling, air-cooling, water cooling - thermosyphon and pump cooling, radiator, pump, thermostat, antifreeze solution and radiator fan. Lubrication Systems – Mist, splash, forced, dry sump and wet sump, oil filters and oil pumps.

UNIT IV

Supercharging and Turbocharging: Necessity of supercharging, mechanical supercharging and turbocharging, compressors and turbines for supercharging, degree of supercharging, methods of supercharging and efficiency of supercharged engine.

UNIT V

Engine Testing and Performance: Indicated power, brake power, engine torque, mechanical efficiency, air standard efficiency, brake thermal efficiency, indicated thermal efficiency, relative efficiency, volumetric efficiency and heat balance sheet.

Engine Emissions: Emissions, sources of emission, effect of pollution on human health and emission norms.

TEXT BOOKS

1. Heinz Heisler, “Advanced Engine Technology”, SAE 1995.
2. Ganesan V, “Internal Combustion Engines”, 4th edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES

1. Richard Stone, “Fundamentals of Automotive Engines”, SAE Publications.
2. Obert E F, “Internal Combustion Engine analysis and Practice ", International Text Book Co., Scranton, Pennsylvania, 1988.
3. John B Heywood, “Internal Combustion Engine Fundamentals”, McGraw Hill International Editions, 1988.
4. Mathur L and Sharma R P, “Internal Combustion Engines”, Dhanpat Rai Publications (P), Ltd, 8th edition, New Delhi.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Year II Semester **L T/P/D C**
3 1 4

(5AE03) THEORY OF MACHINES

Course Prerequisites: Engineering Mathematics, Engineering Mechanics and Engineering Drawing.

Course Objectives

- **Know** different machine elements and mechanisms
- **Understand** kinematic and dynamic characteristics of different mechanisms
- **Select** suitable drives and mechanisms for a particular application
- **Discuss** the concepts of balancing of masses and gyroscope

Course Outcomes

After completion of the course the student is able to

- **Identify** mechanisms and predict their motion
- **Analyse** kinematic and dynamic characteristics of different mechanisms
- **Apply** suitable drives and mechanisms
- **Evaluate** balancing of masses and gyroscope

UNIT I

Mechanisms and Machines: Introduction, mechanism and machine, rigid and resistant bodies, link, kinematic pair, degrees of freedom, classification of kinematic pairs, kinematic chain linkage, mechanism and structure and mobility of mechanisms.

The four-bar chain, the slider-crank chain and double slider-crank chain mechanisms, inversions of these mechanisms and mechanical advantage.

Plane Motion of Body: Instantaneous center of rotation, centrode - relative motion between two bodies-Three centers in line theorem.

UNIT II

Kinematics: Velocity and acceleration-motion of link in machine - Determination of velocity and acceleration diagrams, graphical method, application of relative velocity method and 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 and dynamic analysis of slider-crank mechanism.

UNIT III

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. Analysis of motion of followers - Roller follower, circular cam with straight, concave and convex flanks.

UNIT IV

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.

Gear Trains: Introduction, train value, types - Simple and reverted wheel trains, epicyclic gear train, methods of finding train value or velocity ratio and selection of gear box differential gear for an automobile.

UNIT V

Turning Moment Diagrams: Inertia torque, angular velocity and acceleration of connecting rod, crank effort and torque diagrams.

Gyroscope: Angular velocity, angular acceleration, gyroscopic torque, gyroscopic effect on naval ships, stability of an automobile and stability of a two-wheel vehicle.

Balancing: Introduction, static balancing, dynamic balancing, transference of a force from one Plane to another, balancing of several masses in different planes, force balancing of linkages and balancing of reciprocating mass.

TEXT BOOKS

1. Ratan S S, Theory of Machines, Tata McGraw Hill Publications, 2014.
2. Shigley, Theory of machines, Oxford University Press, 2010.

REFERENCES

1. Thomas Bevan, Theory of Machines, Pearson Education, 2005.
2. Khurmi R S and Gupta J K, Theory of machines, S. Chand Publications, 2005.
3. Bansal R K, Theory of machines, Laxmi Publications, 2011.
4. Sadhu Singh, Theory of machines, Pearson Education, 2006.
5. Ballaney P L, Theory of Machines, Khanna Publishers, 2001.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Year II Semester

L	T/P/D	C
3	0	3

(5EE23) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to ME & AE)

Course prerequisites: Physics, Electrical Engineering & Electronics Engineering

Course Objectives

- Get **awareness** of using mechanical energy for electrical energy generation.
- **Understand** the working basic operation of circuits used for automobile control
- **Know** about working of different electrical machines used for propulsion of vehicles
- **Know** the working operation of diode and transistor

Course Outcomes

After completion of the course the student is 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

B.Tech. II Year II Semester - ME & AE

L	T/P/D	C
0	6	3

(5ME57) MACHINE DRAWING

(Common to ME & AE)

Course Prerequisites: Engineering Graphics

Course Objectives

- **Remember** the principles of machine drawing conventions
- **Analyze** the machine elements like screw threads, nuts, bolts, keys and riveted joins
- **Remember** the machine elements and simple parts like shaft couplings, Journal, pivot and collar bearings
- **Evaluate** the different views of part drawings and based on that, draw the assembled parts of engine and machine parts

Course Outcomes

After completion of the course the student is able to

- **Apply** the knowledge of machine drawing conventions
- **Analyze** and draw the machine elements like screw threads, nuts, bolts, keys and riveted joins
- **Analyze** and draw the machine elements and simple parts like shaft couplings, journal, pivot and collar bearings
- **Analyze** all the parts and 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 BOOKS

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

REFERENCES

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(5AE51) AUTOMOTIVE ENGINES LABORATORY

Course Prerequisites: Automotive engine operation and working of engine systems

Course Objectives

- **Illustrate** valve and port timing diagrams
- **Testing** and performance characteristics of IC engine and compressor
- **Measurement** of engine emissions
- **Estimate** heat balancing of an engine

Course Outcomes

After completion of the course the student is able to

- **Demonstrate** valve and port timing diagrams
- **Evaluate** performance characteristics of IC engine and compressor
- **Practice** measurements of emission testing
- **Perform** heat balancing of an engine

LIST OF EXPERIMENTS (Any ten experiments)

1. Valve timing diagram for 4-Stroke Diesel engine
2. Valve timing diagram for 4-Stroke petrol engine
3. Port timing diagram for 2-Stroke petrol engine
4. Performance test on 4-Stroke single cylinder Diesel engine
5. Performance test on 2-Stroke petrol engine
6. Heat balance test on 4-Stroke single cylinder Diesel engine
7. Optimum cooling temperature test on single cylinder Diesel engine
8. Morse test on multi-cylinder petrol engine
9. Performance test on computerised Diesel engine
10. Performance test on computerised duel fuel engine
11. Exhaust gas analysis on computerised Diesel engine by flue gas analyser
12. Permanence test on reciprocating compressor test rig

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. II Year II Semester

L	T/P/D	C
0	3	2

(5EE63) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

(Common to ME & AE)

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

After completion of the course the student is 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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(5BS04) GENDER SENSITIZATION

(Common to CE, EEE, ME, ECE, CSE, EIE, IT & AE)

Course Objectives

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

Course Outcomes

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

UNIT I

UNDERSTANDING GENDER

Gender: Why Should We Study It? (Towards a word of Equals: Unit-1)

Socialization: Making Women, Making Men (Towards a word of Equals: Unit-2)
Introduction, Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

Just Relationships: Being Together as Equals (Towards a world of Equals: Unit-12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters, Mothers and Fathers.
Further Reading: Rosa Parks-The Brave Heart.

UNIT II

GENDER AND BIOLOGY

Missing Women: Sex Selection and Its Consequences (Towards a word of Equals: Unit-4)
Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary (Towards a word of Equals: Unit-10)
Two or Many? Struggles with Discrimination.
Additional Reading: Our Bodies, Our health (Towards a word of Equals: Unit-13)

UNIT III

GENDER AND LABOUR

Housework: the Invisible Labour (Towards a word of Equals: Unit-3)
"My Mother doesn't Work.""Share the Load."
Women's Work: Its Politics and Economics (Towards a word of Equals: Unit-7)
Fact and Fiction. Unrecognized and Unaccounted work. Further Reading: Wages and Conditions of Work.

UNIT IV

ISSUES OF VOILENCE

Sexual Harassment: Say No! (Towards a word of Equals: Unit-6)
Sexual Harassment: not Eve-Teasing-Coping with Everyday Harassment-Further Reading: "Chupulu".
Domestic Violence: Speaking Out (Towards a word of Equals: Unit-8)
Is Home a Safe Place?-When Women Unite [Film]. Rebuilding Lives. Further Reading: New Forums for Justice.
Thinking about Sexual Violence (Towards a word of Equals: Unit-11)
Blaming the Victim-"I fought for my Life..."- Further reading: The Caste Face of Violence.

UNIT V

GENDER AND STUDIES

Knowledge: Through the Lens of Gender (Towards a word of Equals: Unit-5)
Point of View. Gender and the Structure of Knowledge. Further Reading: Unacknowledged Women Artists of Telangana.
Whose History? Questions for Historians and Others (Towards a word of Equals: Unit-9)
Reclaiming a Past. Writing Other Histories. Further Reading. Missing Pages from Modern Telangana History.
Essential Reading: all the Units in the Textbook, "Towards a word of Equals: A Bilingual Textbook on Gender" written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Malkote, Vasudha Nagaraj, Asma rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu.

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

REFERENCES

1. Sen, Amartya. “More than One Million Women are Missing.” New York Review of Books 37.20 (20 December 1990). Print. ‘We Were Making History...’ Life Stories of Women in the Telangana People’s Struggle. New Delhi: Kali for Women, 1989.
2. Tripti Lahiri. “By the Numbers: Where Indian Women Work.” Women’s Studies Journal (14 November 2012) Available online at : http://blogs.wsj.com/India real time/2012/11/14/by-the-numbers-where-India-women-work/>
3. K. Satyanarayana and Susie tharu(Ed) Steel Nibs are Sprouting: New Dalit Writing from South India Dossier 2: Telugu and Kannada http://harpercollins.co.in/BookDetail.asp?Book Code =3732
4. Vimala . “Vantillu (The Kitchen)”. Women Writing in India: 600 BC to the Present. Volume II: The 20th Century. Ed. Susie Tharu and K. Lalita. Delhi: Oxford University Press, 1995. 599-601.
5. Shatrughna, Veena et al. Women’s Work and its Impact on Child Health and Nutrition, Hyderabad, National Institute of Nutrition, Indian Council of Medical Research. 1993.
6. Stree Shakti Sanghatana. “ We Were Making History.....’Life Stories of Women in the Telangana People’s Struggle. New Delhi: Kali for Women, 1989.
7. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012.
8. Jayaprabha, A. “Chupulu (Stares)”, Women Writing in India: 600 BC to the Present. Volume II: The 20th Century. Ed. Susie Tharu and K. Lalita. Delhi: Oxford University Press, 1995. 596-597.
9. Javeed, Shayan and Anupam Manuhaar. “Women and wage Discrimination in India: A Critical Analysis.”International Journal of Humanities and Social Science Invention 2.4 (2013).
10. Gautam , Liela and Gita Ramaswamy. “A ‘conversation’ between a Daughter and a Mother.”Broadsheet on Contemporary Politics, Special issue on Sexuality and Harassment: gender Politics on Campus Today. Ed. Madhumeeta Sinha and Asma rasheed. Hyderabad: Anveshi Research Center for Women’s Studies, 2014.
11. Abdulali Sohaila “I Fought For My Life ...and Won. “Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/
12. Jeganathan Pradeep, Partha Chatterjee (Ed). “Community, Gender and Violence Subaltern Studies XI’
13. Permanent Black and ravi Dayal Publishers, New Delhi, 2000.
14. K. Kapadia. The Violence of Development: the Politics of Identity, Gender and Social Inequalities in India. London: Zed Books, 2002.
15. S. Benhabib. Situating the Self: Gender, Community, and Postmodernism in Contemporary Ethics, London: Routledge, 1992.
16. Virginia Woolf. A Room of One’s Own. Oxford: Black Swan. 1992.
17. T. Banuri and M. Mahmood, Just Development: Beyond Adjustment with a Human Face, Karachi: Oxford University Press, 1997.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Year I Semester

L	T/P/D	C
3	0	3

(5AE04) AUTOMOTIVE CHASSIS

Course Prerequisites: Theory of Machines

Course objectives

- **Understand** the fundamental concepts of automotive systems.
- **Discuss** the basic functionality of these automotive systems
- **Provide** working of drive line systems like clutch, gear box and differential
- **Learn** constructional features and working of automotive steering, braking and suspension systems

Course Outcomes

After completion of the course the student is able to

- **Appreciate** the concepts and technologies available in automobiles
- **Explain** automotive lay-out and functionality of chassis systems
- **Present** working of drive line systems like clutch, gear box and differential
- **Explain** constructional features and working of automotive steering, braking and suspension systems

UNIT I

Introduction: Classification of automobiles, layout of chassis and sub systems and their role.

Frame and Body: Types of chassis – Light, medium and heavy duty vehicle chassis, ladder chassis, and integral body. Role and requirement of a chassis frame, types of frames, materials, loading points and types of bodies.

UNIT II

Clutch: Role, types - types of clutches, single plate clutch, coil spring type and diaphragm spring type, multiple plate clutch, centrifugal clutch, calculation of torque transmission, over running clutch.

Gear Box: Need for a gearbox, types of gear boxes, sliding mesh, constant mesh and synchromesh gear boxes, calculation of gear ratios, epicyclical gearboxes, transfer case - auxiliary gearbox and gear shifting mechanisms.

UNTI III

Axle: Live and dead axles, front axle and its types, stub axle and its types, rear axle and its types, fully floating, semi- floating and three quarter floating axles.

Final Drive and Differential: Need for final drive and differential, types of final drives, single reduction and double reduction final drives, differential and its types, conventional and non-slip differentials and differential lock.

Wheels and Tyres: Types of wheels, construction of wheel, tyre requirements, bias ply and radial ply tyres, tubeless tyres, wheel balancing and tyre rotation.

UNIT IV

Steering System: Desirable characteristics, principle of steering, steering linkage layout, reversible and irreversible steering. Steering gearbox – Purpose, types of steering gearboxes. Front wheel alignment and steering geometry, centre point steering. Power steering – Purpose, basic principle, types of power steering.

Brake System: Need, characteristics of braking system, principle of working of a braking system, wheel locking and stopping distance, self energizing and self locking. Types of brakes – Drum brakes, disc brakes. Types of brake actuating systems – Mechanical brakes, hydraulic brakes, power brakes and servo brakes.

UNIT V

Suspension System: Desirable characteristics. Types of suspension systems – Rigid axle suspension and independent suspension systems. Types of suspension springs – Leaf springs, coil springs, torsion bar springs, air springs, rubber springs, hydro elastic springs. Linked suspension system, variable rate sprints. Shock absorbers – Role of shock absorber – Types of shock absorbers, construction and working of telescopic shock absorber.

TEXTBOOKS

1. Garrett T K, Newton K. and Steeds W., Motor Vehicle, Butter Worths & Co. Publishers Ltd., New Delhi, 2001.
2. Heinz Heisler, Advanced Vehicle Technology, Butterworth Heinemann Publishers, 2002.

REFERENCES

1. Heldt P M, Automotive Chassis, Chilton & Co., 1996.
2. Crouse W H, Automotive Chassis and Body, McG raw Hill Book Co., 5th edition, 1976.
3. Crouse W H, Automotive Transmissions and Power Trains, McGraw Hill Book Co., 5th edition, 1976.
4. Khatawate N R, Introduction to Automobile Engineering, Khanna publications.
5. Joseph I Heitner, Automotive mechanics,. Affiliated East West Press.
6. Giri N K, Automotive Mechanics, Khanna Publications, 2006.

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VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Year I Semester **L T/P/D C**
3 0 3

(5AE05) AUTOMOTIVE ELECTRICAL AND ELECTRONICS

Course Prerequisites: Automotive Chassis and Basic Electrical and Electronics Engineering

Course objectives

- **Study** the fundamentals, working and advanced concepts of automotive battery, ignition and starting systems
- **Understand** the working of basic and advanced concepts of automotive charging and lighting systems
- **Learn** basics of automotive electronics and working principle of sensors and actuators
- **Provide** an overview on control system concepts in engine control

Course Outcomes

After completion of the course the student is able to

- **Explain** the fundamentals, working and advanced concepts of automotive battery, ignition and starting systems
- **Discuss** the working of basic and advanced concepts of automotive charging and lighting systems
- **Present** basics of automotive electronics and working principle of sensors and actuators
- **Apply** control system concepts in engine control

UNIT I

Batteries: Lead acid and alkaline batteries, battery rating, battery testing and maintenance.
Starting System: Principle and construction of starter motor, working of different starter drive units and solenoid switches.

UNIT II

Ignition System: Conventional ignition system and study of its components. Types of ignition systems, spark advance and retarding mechanisms. Types of spark plugs, ignition timing, maintenance, servicing and fault diagnosis. Electronic ignition systems, programmed ignition and distributor-less ignition.

UNIT III

Charging System: DC and AC Generators – principle, construction and working, cut-outs and regulators and charge balancing.

Lighting System: Insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods. Horn, wiper system and trafficator.

UNIT IV

Sensors and Actuators: Classification of sensors, sensor for speed, knock, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors and relay.

UNIT V

Electronic Engine Controls: Concept of an electronic engine control system, electronic fuel injection - throttle body fuel injection, multi point fuel injection, gasoline direct injection, common rail direct injection, electronic ignition control, engine mapping, on-board diagnostics – engine control module and powertrain control module.

TEXT BOOKS

1. Crouse W H, “Automobile Electrical Equipment”, McGraw Hill Book Co., Inc., New York 3rd edition,1986.
2. William B Ribbens, “Understanding Automotive Electronics”, 5th edition, Butter worth Heinemann Woburn, 1998.

REFERENCES

1. Bechhold “Understanding Automotive Electronics” SAE, 1998.
2. Judge A W, “Modern Electrical Equipment of Automobiles”, Chapman & Hall, London,1992.
3. Robert Bosch, “Automotive Hand Book” SAE, 5th edition, 2000.
4. Kholi P L, “Automotive Electrical Equipment”, Tata McGraw Hill Co., Ltd., New Delhi, 1975.
5. Young A P and Griffiths L, “Automotive Electrical Equipment”, ELBS & New Press, 1999.
6. “Automotive Electrics Automotive Electronics”, 4th Edition, Robert Bosch GmbH, 2004.

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VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Year I Semester

L	T/P/D	C
3	1	4

(5AE06) AUTOMOBILE ENGINEERING DESIGN - I

Course Prerequisites: Engineering Mathematics, Engineering Physics, Engineering Mechanics, Theory of Machines and Metallurgy and Materials Science.

Course Objectives

- **Identify** the properties of materials and relationship among them
- **Understand** the design considerations for structural members under fluctuating loads
- **Compare** and evaluate different types of fasteners
- **Appraise** power transmitting elements in automobiles

Course Outcomes

After completion of the course the student is able to

- **Choose** the materials based on design considerations
- **Analyse** the behavior of structural members under fluctuating loads
- **Select** and design different types of fasteners
- **Design** power transmitting elements in automobiles

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 of 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 and impact stresses.

UNIT II

Design against Fluctuating Load: Stress concentration, stress concentration factors, reduction 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. Soderberg and Goodman lines the fatigue strength, modified Goodman theory, Soderberg theory and Gerber theory.

UNIT III

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

Riveted and Welded Joints: 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

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 and timing belts.

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

UNIT V

Shafts, Keys and Couplings: Transmission shafts, design of solid and hollow shafts based on strength, rigidity and flexible shafts – Key and classification of keys, stresses in the keys and design considerations. Rigid couplings – Muff, split muff and flange couplings – Bushed - pin flexible coupling.

Flywheels: Flywheel governor, Flywheel materials, torque analysis, coefficient of fluctuation of energy, solid disk flywheel, stresses in rimmed flywheel.

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Year I Semester **L T/P/D C**
3 0 3

(5ME07) PRODUCTION TECHNOLOGY

(Common to ME & AE)

Course Prerequisites: Material Science and Manufacturing Science

Course Objectives

- **Understand** about sand casting and metal casting techniques
- **Impart** the knowledge of various welding processes
- **Understand** about the importance rolling, forging and sheet metal operations
- **Understand** about the processing of plastics

Course Outcomes

After completion of the course the student is able to

- **Analyze** and select the suitable casting technique for making the components
- **Analyze** the different types of welding processes are needed for various materials and importance of welding
- **Know** the methods involved in sheet metal operations, rolling, forging, etc.
- **Know** the various manufacturing methods in processing of plastics

UNIT I

Casting: Steps involved in making a casting; Advantage of casting and its applications; Types of Foundry sands, Types of patterns – Materials used for patterns; Pattern allowances and their construction; Principles of Gating, Gating ratio and design of gating systems.Risers; Types; Casting design considerations;

Special casting processes: Centrifugal, Die, Investment casting only, Cupola furnace and Electric arc furnace only.

UNIT II

Welding: Classification of welding processes, types of welds and welded joints ,Gas welding, ARC welding, Resistance welding, Thermit welding and Plasma welding. TIG & MIG welding, Friction stir welding, Explosive welding, Soldering & Brazing. Heat affected zones in welding; welding defects.

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. **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.

UNIT V

Plastic Materials and Process: Types of plastics; advantages of plastics, Injection moulding; Blow moulding; Thermoforming. Compression moulding.

TEXT BOOKS

1. Manufacturing Technology by P.N. Rao.
2. Production Technology by R.K. Jain.

REFERENCES

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

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Year I Semester

L	T/P/D	C
3	0	3

(5ME10) HEAT AND MASS TRANSFER

(Common to ME & AE)

Course Prerequisites: Engineering Mathematics and Thermodynamics.

Course Objectives

- **Measure** the conduction mode of heat transfer in physical environment and to derive general mathematical equation
- **Measure** the heat transfer through Homogeneous slabs, hollow cylinders, sphere, extended surfaces and fins.
- **Measure** convective mode of heat transfer
- **Measure** heat transfer during radiation, boiling and condensation
- **Measure** heat transfer through different types of heat exchangers

Course Outcomes

After completion of the course the student is able to

- **Derive** the general conduction equation in Cartesian, cylindrical and spherical coordinates
- **Derive** and apply equations in problems related to heat transfer through homogeneous slabs, hollow cylinders ,sphere, extended surfaces and fins
- **Derive** and apply the convective heat transfer equations to natural and forced flow
- **Design** the devices that transfers heat and measure their effectiveness

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Year I Semester	**L**	**T/P/D**	**C**
Open Elective I	**3**	**0**	**3**

(5CE71) 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

After completion of the course the student is 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 I

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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B.Tech. III Year I Semester	**L T/P/D C**
Open Elective I	**3 0 3**

(5EE71) RENEWABLE ENERGY TECHNOLOGIES

Course Objectives:

• To provide necessary knowledge about the modeling, design and analysis of various PV systems

• To show that PV is an economically viable, environmentally sustainable alternative to the world's energy supplies

• To understand the power conditioning of PV and WEC system's power output

Course Outcomes:

After Completion of the course the student is able to

• Model, analyze and design various photovoltaic systems

• Know the feasibility of various storage systems

• Design efficient stand alone and grid connected PV and WEC power systems

UNIT I

Introduction to photovoltaic (pv) systems:

Historical development of PV systems- Overview of PV usage in the world Photovoltaic effect-conversion of solar energy into electrical energy.

Solar cells and arrays

Behavior of solar cells-basic structure and characteristics: types - equivalent circuit-modeling of solar cells including the effects of temperature, irradiation and series/shunt resistances on the open-circuit voltage and short-circuit currentSolar cell arrays- PV modules-PV generators-shadow effects and bypass diodes- hot spot problem in a PV module and safe operating area-Terrestrial PV module modelingInterfacing PV modules with different loads.

UNIT II

Energy storage alternatives for pv systems

Methods of Energy storage –Pumped Energy Storage – Compressed Energy Storage – Storage batteries- lead-acid- nickel cadmium-nickel-metal-hydride and lithium type batteries. Small storage systems employing ultra capacitors- properties- modeling of batteries.

UNIT-III

Wind Energy Conversion systems (WECS)

Basic Principle of WECS, Nature of Wind, Wind survey in india, Components of WECS, Power Vs Speed, TSR, Maximum Power operation, WECS- Trade off- Control Requirements, Basic Principle of Induction generator for WECS

UNIT-IV

Converters for PV and Wind

AC-DC Rectifier, DC-AC inverter (Basic operation) Grid interface voltage and frequency control, Battery charger (Basic operation)

Power conditioning of PV systems

Array Design, Sun Tracking, Single axis-Dual Axis, Maximum Power point Tracking- PO method- IC method

UNIT-V

Stand Alone systems:

PV Stand Alone, Electric Vehicle, Wind stand Alone, Standalone Hybrid systems- Hybrid with diesel, Hybrid with Fuel cell- Mode controller- Load sharing, systems sizing, wind farm sizing- Power and Energy estimates, , Residential systems, PV water pumping, PV powered lighting-

TEXT BOOKS

1. Patel M. R., "Wind and Solar Power Systems Design, Analysis, and Operation", CRC Press, New York, 2nd Edition, 2005
2. Goetzberger, Hoffmann V. U., "Photovoltaic Solar Energy Generation", SpringerVerlag,Berlin, 2005.

REFERENCES

1. Komp R.J., "Practical Photovoltaics: Electricity from solar cells", Aatec Publications,Michigan, 3rd Edition, 2001.
2. Castaner L., Silvestre S., "Modeling Photovoltaic Systems Using PSpice", John Wiley & Sons, England, 2002.
3. Jenny Nelson, "The physics of solar cells", Imperial College Press, London, 2004.

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B.Tech. III Year I Semester	**L T/P/D C**
Open Elective I	**3 0 3**

(5ME71) DIGITAL FABRICATION

Course Objectives

- **Understand** the need of digital fabrication
- **Understand** about Two dimensional layer by layer techniques
- **Know** about extrusion based systems, post processing and the software issues involved in digital fabrication
- **Know** the applications of digital fabrication

Course Outcomes

After completion of the course the student is able to

- **Understand** the importance of digital fabrication
- **Identify** different techniques involved in two dimensional layering
- **Analyze** the software issues involved in digital fabrication and know about extrusion based systems and post processing
- **Apply** the knowledge gained in the digital fabrication

UNIT I

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Classification of Additive Manufacturing, Distinction between AM & CNC Machining, Advantages of AM.

UNIT II

Two- Dimensional Layer- by Layer Techniques: Stereolithography (SL), Solid Foil Polymerization (SFP), Selective Laser Sintering (SLS), Selective Powder Building (SPB), Ballistic Particle Manufacturing (PM).

UNIT III

Extrusion Based Systems: Introduction, basic principles, Fused Deposition Modeling, Materials, Limitations of FDM

Post Processing: Introduction, Support Material Removal, Surface Texture Improvements, Accuracy Improvements, Aesthetic Improvements.

UNIT IV

Software Issues for Additive Manufacturing: Introduction, Preparation of CAD Models: The STL file, Problems with STL files, STL file manipulation, Beyond the STL file, Additional software to assist AM.

UNIT V

AM Applications:

Applications in design, Applications in Engineering Analysis and Planning.

Medical Applications: Customized Implants and Prosthesis.

Aerospace applications and Automotive Applications.

Other Applications: Jewelry Industry, Coin Industry, Tableware Industry.

TEXT BOOKS

1. Ian Gibson, David W Rosen, Brent Stucker, “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer 2010.
2. Chuaa Chee Kai, Leong Kah Fai, “Rapid Prototyping: Principles & Applications”, World Scientific, 2010.

REFERENCES

1. Ali K.Karmani, Emand Abouel Nasr, “Rapid Prototyping: Theory and Practice”, Springer 2006.
2. Andreas Gebhardt, Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Hanser Publishers, 2013.
3. Hopkinson, N.Haque, and Dickens Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, Taylor and Francis, 2007.

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B.Tech. III Year I Semester	**L**	**T/P/D**	**C**
Open Elective I	**3**	**0**	**3**

(5EC71) PRINCIPLES OF ELECTRONIC COMMUNICATIONS
(Qualitative Analysis only)

Course Objectives

- **Make** students understand different types of communication
- **Make** students understand different modulation technique
- **Make** students understand basics of wireless communications
- **Make** students understand basics of cellular communications

Course Outcomes

After completion of the course the student is able to

- **Analyze** the techniques used for signal modulation and demodulation
- **Distinguish** the need for PPM, PWM, Multiplexing
- **Learn** basics of wireless networks
- **Understand** the fundamental concepts of Cellular & Mobile communications

UNIT I

Introduction: Block diagram of Electrical communication system, Radio communication, Types of communications: Analog, pulse and digital.

Analog Modulation: Need for modulation, Types of Analog modulation, Amplitude Modulation, Angle Modulation: Frequency & Phase modulations. Generation and Demodulation techniques. Advantages of FM over AM, Bandwidth consideration, Narrow band and Wide band FM, Comparison of FM & PM.

UNIT II

Pulse Modulations: Sampling, Nyquist rate of sampling, Sampling theorem for Band limited signals, PAM, regeneration of base band signal, PWM and PPM, Time Divison Multiplexing, Frequency Divison Multiplexing, Asynchronous Multiplexing.

UNIT III

Digital Communication: Advantages, Block diagram of PCM, Quantization, effect of quantization, quantization error, Base band digital signal, DM, ADM, ADPCM and comparison. Digital Modulation : ASK, FSK, PSK, DPSK, QPSK demodulation, offset and non-offset QPSK, coherent and incoherent reception, Modems.

UNIT IV

Introduction to Wireless Networking: Introduction, Difference between wireless and fixed telephone networks, Development of wireless networks, Traffic routing in wireless networks.

UNIT V

Cellular Mobile Radio Systems: Introduction to Cellular Mobile System, concept of frequency reuse, Performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Analog and Digital Cellular systems. Cell splitting.

Handoffs and Dropped Calls: Handoff, dropped calls and cell splitting, types of handoff, handoff initiation, delaying handoff, forced handoff, mobile assisted handoff, Intersystem handoff, micro cells, vehicle locating methods, dropped call rates and their evaluation.

TEXT BOOKS

1. Communication Systems Analog and Digital – R.P. Singh and SD Sapre, TMH, 20th reprint, 2004.
2. Principles of Communications – H. Taub and D. Schilling, TMH, 2003.

REFERENCES

1. Electronic Communication Systems – Kennedy and Davis, TMH, 4th edition, 2004.
2. Communication Systems Engineering – John. G. Proakis and Masoud Salehi, PHI, 2nd Ed. 2004.
3. Wireless Communication and Networking – William Stallings, 2003, PHI.
4. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, 2nd Ed., 2002, PHI.

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B.Tech. III Year I Semester	**L**	**T/P/D**	**C**
Open Elective I	**3**	**0**	**3**

(5CS71) OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Course Objectives

- **Implement** Different object-oriented Concepts in Java
- **Develop** the concepts of Multi-Threading and IO-Streams
- **Construct** GUI models

Course Outcomes

After completion of the course the student is able to

- **Write** Java programs using various programming constructs using java
- **Solve** different mathematical problems using OOP Paradigm
- **Design** and analyze the solutions for Thread and I/O management Concepts
- **Implement** the Applications involving GUI models and Events

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.

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.

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.

REFERENCES

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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	L	T/P/D	C
B.Tech. III Year I Semester			
Open Elective I	**3**	**0**	**3**

(5EI71) PRINCIPLES OF MEASUREMENTS AND INSTRUMENTATION

Course Objectives

- **Provide** basic knowledge in transduction principles, sensors and transducer technology and measurement systems
- **Provide** better familiarity with the concepts of Sensors and Measurements
- **Provide** the knowledge of various measurement methods of physical parameters like velocity, acceleration, force, pressure and viscosity

Course Outcomes

After completion of the course the student is able to

- **Identify** suitable sensors and transducers for real time applications
- **Translate** theoretical concepts into working models
- **Understand** the basic of measuring device and use them in relevant situation
- **Estimate** the errors in measurement by means of calibrating the different instruments against the standards.

UNIT I

Introduction to measurements. Physical measurement. Forms and methods of measurements. Measurement errors. Statistical analysis of measurement data. Probability of errors. Limiting errors.

Standards. Definition of standard units. International standards. Primary standards. Secondary standards. Working standards. Voltage standard. Resistance standard. Current standard. Capacitance standard. Time and frequency standards.

UNIT II

PASSIVE SENSORS

Resistive Sensors: Potentiometers, Strain Gages, Resistive Temperature Detectors (RTDs), Thermistors, Light-dependent Resistors (LDRs), Resistive Hygrometers , **Capacitive Sensors:** Variable capacitor, Differential capacitor, **Inductive Sensors:** Reluctance variation sensors, Eddy current sensors

UNIT III

Metrology: Measurement of length – Plainness – Area – Diameter – Roughness – Angle – Comparators – Gauge blocks. Optical Methods for length and distance measurements.

Velocity and Acceleration Measurement: Relative velocity – Translational and Rotational velocity measurements – Revolution counters and Timers - Magnetic and Photoelectric pulse counting stroboscopic methods. Accelerometers- different types, Gyroscopes-applications.

UNIT IV

Force and Pressure Measurement: Gyroscopic Force Measurement – Vibrating wire Force transducer. Basics of Pressure measurement – Manometer types – Force-Balance and Vibrating Cylinder Transducers – High and Low Pressure measurement

UNIT V

Flow, Density and Viscosity Measurements: Flow Meters- Head type, Area type (Rota meter), electromagnetic type, Positive displacement type, Density measurements – Strain Gauge load cell method – Buoyancy method. Units of Viscosity, Two float viscorator – Industrial consistency meter

TEXT BOOKS

1. Measurement Systems – Applications and Design – by Doeblin E.O., 4/e, McGraw Hill International, 1990.
2. Principles of Industrial Instrumentation – Patranabis D. TMH. End edition 1997

REFERENCES

1. Sensor Technology Hand Book – Jon Wilson, Newne 2004.
2. Instrument Transducers – An Introduction to their Performance and design – by Herman K.P.Neubrat, Oxford University Press.
3. Measurement system: Applications and Design – by E.O.Doeblin, McGraw Hill Publications.
4. Electronic Instrumentation by H.S.Kalsi.

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B.Tech. III Year I Semester	**L**	**T/P/D**	**C**
Open Elective I	**3**	**0**	**3**

(5IT71) CYBER SECURITY

Course Objectives:

- **Identify** the key components of cyber security in network
- **Describe** risk management processes and practices
- **Define** types of service delivery process and storage management process
- **Access** additional external resources to supplement knowledge of cyber forensics and laws

Course Outcomes:

After completion of the course the student is able to

- **Categorization** of cyber-crime and an understanding social, political, ethical and psychological dimensions cyber security
- **Demonstrate** cyber offenses tools, methods used in cyber crime
- **Document** an appropriate procedure of Risk Management and Security Standards
- **Understanding** computer forensics and analyzing them

UNIT-I

INTRODUCTION TO CYBER CRIME: Introduction Cybercrime: Definition and Origins of the word, Cybercrime and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, E-mail Spoofing, Spamming, Cyber defamation, Internet Time Theft, Salami Attack/ Salami Technique, Data Diddling, Forgery, Web Jacking, Newsgroup Spam/ Crimes Emanating from Usenet Newsgroup, Industrial Spying/Industrial Espionage, Hacking, Online Frauds, Pornographic Offenses, Software Piracy, Computer Sabotage, E-Mail Bombing/Mail Bombs, Usernet Newsgroup as the Source of Cybercrimes, Computer Network Intrusions, Password Sniffing, Credit Card Frauds, Identity Theft, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, Hacking and the Indian Law(s), A Global Perspective on Cybercrimes, Cybercrime and the Extended Enterprise.

UNIT-II

CYBER OFFENSES: HOW CRIMINALS PLAN THEM: Introduction, Categories of Cybercrime, How Criminals Plan the Attacks, Reconnaissance, Passive Attacks, Active Attacks, Scamming and Scrutinizing Gathered Information, Attack (Gaining and Maintaining the System Access), Social Engineering, Classification of Social Engineering, Cyber stalking, Types of Stalkers, Cases Reported on Cyber stalking, How Stalking Works?, Real-Life Incident of Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The fuel for Cybercrime, Botnet, Attack Vector, Cloud Computing, Why Cloud Computing?, Types of Services, Cybercrime and Cloud Computing.

UNIT-III

TOOLS AND METHODS USED IN CYBER CRIME: Introduction, Proxy Servers and Anonymizers, Phishing, How Phishing Works, Password Cracking, Online Attacks, Offline Attacks, Strong, Weak and Random Passwords, Random Passwords, Keyloggers and Spywares, Software Keyloggers, Hardware Keyloggers, Antikeylogger, Spywares, Virus and Worms, Types of Viruses, Trojan Horses and Backdoors, Backdoor, How to Protect from Trojan and Backdoors, Steganography, Steganalysis, Dos and DDos Attacks, Dos Attacks, Classification of Dos Attacks, Types of Levels of Dos Attack, Tools Used to Launch Dos Attacks, DDos Attacks, How to protect from Dos/DDos Attacks, SQL Injection, Steps for SQL Injection Attack, How to Prevent SQL Injection Attacks.

UNIT-IV

UNDERSTANDING COMPUTER FORENSICS: Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, The Rules of Evidence, Forensics Analysis of E-Mail, RFC2822, Digital Forensics Life Cycle, The Digital Forensics Process, The Phases in Computer Forensics/Digital Forensics, Precautions to be Taken when Collecting Electronic Evidence, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Typical Elements Addressed in a Forensics Investigation Engagement Contract , Solving a Computer Forensics Case, Computer Forensics and Steganography, Rootkits, Information Hiding, Forensics and Social Networking Sites: The Security/Privacy Threats, Challenges in Computer Forensics, Technical Challenges: Understanding the Raw Data and its Structure, The Legal Challenges in Computer Forensics and Data Privacy Issues, Special Tools and Techniques, Digital Forensics Tools Ready Reckoner, Special Technique: Data Mining used in Cyber forensics, Forensics Auditing.

UNIT-V

CYBERCRIME AND CYBERTERRORISM: SOCIAL, POLITICAL, ETHICAL and PSYCHOLOGICAL DIMENSIONS: Introduction, Intellectual Property in the Cyberspace, Copyright, Patent, Trademarks, Trade Secret, Trade Name, Domain Name, The Ethical Dimension of Cybercrimes, Ethical Hackers: Good Guys in Bad Land, The Psychology, Mindset and Skills of Hackers and Other Cybercriminals, Inside the Minds and Shoes of Hackers and Cybercriminals, Hackers and Cybercriminals: Evolution of Technical prowess and Skills, Ethical Hackers, Sociology of Cybercriminals, Personality Traits of Cybercriminals and Younger Generation's views about Hacking, Information Warfare: Perception or An Eminent Reality?, Cyberwar Ground is HOT, Cyber Jihadist on the Rise.

TEXT BOOKS:

1. Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belpure, Publication Wiley.

REFERENCES:

1. Management of Information Security, M. E. Whitman, H. J. Mattord, Nelson Education, CENGAGE Learning, 2011, 3rd Edition.

2. Guide to Computer Forensics and Investigations, B. Nelson, A. Phillips, F. Enfinger, C. Steuart, Nelson Education / CENGAGE Learning, 2010, 4th Edition

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Year I Semester	**L**	**T/P/D**	**C**
Open Elective I	**3**	**0**	**3**

(5AE71) PRINCIPLES OF AUTOMOBILE ENGINEERING

Course objectives

- **Understand** the layout of an automobile and functionalities subsystems
- **Provide** overview on concepts of engine, cooling, lubrication and fuel systems
- **Present** constructional features and working of automotive driveline and running systems
- **Study** the fundamentals and principles of automotive electrical systems

Course Outcomes

After completion of the course the student is able to

- **Explain** the functionalities of automotive systems and subsystems
- **Give** an overview on engine and engine subsystems.
- **Describe** working of automotive driveline and running systems
- **Discuss** the concepts of automotive starting, ignition and charging systems

UNIT I

Introduction: Classification of automobiles, layout of an automobile, automobile sub systems and their role. Types of chassis, role and requirement of a chassis frame, types of frames, materials, loading points and types of bodies.

UNIT II

Engine: Classification and components of an engine, principle and working of four stoke and two stroke SI and CI engines. Carburetor, diesel fuel injection and introduction to electronic fuel injection system. Cooling - Necessity of cooling, air-cooling and water cooling. Lubrication – Mist, splash and forced system.

UNIT III

Drive Line: Clutches, principle, single plate clutch, multi plate clutch and centrifugal clutch. Gear box - Need, sliding mesh, constant mesh and synchromesh gear box. Propeller shaft, universal joint, differential, wheels and tyres.

UNIT IV

Running Systems: Suspension systems – Objective, rigid axle and independent suspension system and torsion bar. Steering system – Layout, steering mechanism, steering geometry

and steering gearboxes. Brake system – Principle, stopping distance, types of brakes and actuation.

UNIT V

Electrical Systems: Starting system - Principle, working of different starter drive units and solenoid switches. Ignition system **-** Conventional ignition system types, ignition advance and retarding mechanisms. Charging system - Alternator principle, construction and working, cut-outs and regulators.

TEXT BOOKS

1. Heinz Heisler, “Advanced Vehicle Technology”. Butterworth Heinemann Publishers, 2002.
2. Crouse W H, “Automobile Electrical Equipment” , McGraw Hill Book Co., Inc., New York 3rd edition,1986.

REFERENCES

1. Garrett T K, Newton K. and Steeds W. “Motor Vehicle”, Butter Worths & Co. Publishers Ltd., New Delhi, 2001.
2. Kholi P L, “Automotive Electrical Equipment”, Tata McGraw Hill Co., Ltd., New Delhi, 1975.
3. Crouse W H, "Automotive Chassis and Body," McG raw Hill Book Co., 5th edition, 1976.
4. .Giri N K, Automotive Mechanics, Khanna Publications, 2006.

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B.Tech. III Year I Semester	**L**	**T/P/D**	**C**
Open Elective I	**3**	**0**	**3**

(5BS71) PROFESSIONAL ETHICS AND HUMAN VALUES

Introduction

Human values and ethics have a significant role to play in the betterment of our society. Ethics and values are a liberating force, enabling higher performance, better quality relationships and an expanded sense of purpose and identity. This syllabus aims to present a framework for understanding human values and their role in life, work, business and leadership. It aims to transform individuals from having self-focused, survivalist mindset that has scant regard for ethics, through to compliance with laws and conventions, and then to the aspiration to live a higher ethical and spiritual life.

It mainly focuses on improving the capacities of leadership /management through training in human values and professional ethics. It serves to contribute to good governance in the organizations and foster an environment that supports and encourages just practices and fair play.

Course objectives

- **Create** an awareness on Engineering Ethics and Human Values
- **Study** the moral issues and decisions confronting individuals and organizations engaged in engineering profession
- **Study** the related issues about the moral ideals, character, policies, and relationships of people and corporations involved in technological activity

Course Outcomes

After completion of the course the student is able to:

- **Learn** the moral issues and problems in engineering; find the solution to those problems
- **Learn** the need for professional ethics, codes of ethics and roles, concept of safety, risk assessment
- **Gain** exposure to Environment Ethics & computer ethics; know their responsibilities and rights

UNIT I

Introduction to Human Values and Ethics Human Values: Morals, Values and Ethics – Integrity – Work Ethic – ServiceLearning – Civic Virtue – Respect for Others – Living

Peacefully – caring – Sharing –Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

Introduction to Ethical Concepts: Definition of industrial ethics and values, Ethical rules of industrial worker- Values and Value Judgments -- Moral Rights and Moral rules 121 -- Moral character and responsibilities -- Privacy, confidentiality, Intellectual property and the law -- Ethics as law.

UNIT II

Understanding Engineering Ethics: Action Oriented- Ethical Vision- Indian Ethos- Ethics Defined-Engineering Ethics: Various Connotations of Engineering Ethics, Why Study Engineering Ethics?, Personal and Business Ethics-Ethics and the Law-Senses of 'Engineering Ethics' – Variety of moral issues –Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory –Gilligan's theory – Consensus and Controversy – Professions and Professionalism –Professional Ideals and Virtues – Theories about right action – Selfinterest –Customs and Religion – Uses of Ethical Theories -Engineering as a Profession -- Professional Societies -- Core Qualities of Professional Practitioners -- Professional Institutions, Operating in a Pluralistic Society - Environments and Their Impact - Economic Environment -- Capital Labor-- Price Levels -- Government Fiscal and Tax Policies – Customers – Technology.

UNIT III

Engineering as Social Experimentation – Comparison with Standard Experiments, Knowledge Gained Conscientiousness, Relevant Information, Learning from the Past, Engineers as managers, consultants, and Leaders, Accountability, Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law. Engineers and Managers -- Organizational complaint procedures - Government agencies Resolving Employee concerns – Limits on acceptable behavior in large corporations -- Ethical and legal considerations, Organizational responses to offensive behaviour and harassment.

UNIT IV

Workplace Rights and Responsibilities Professional Responsibility: The basis and scope of Professional Responsibility -- Professions and Norms of Professional Conduct -- Ethical Standards versus Profession -- Culpable mistakes -- the Autonomy of professions and codes of ethics - - Employee status and Professionalism -- Central Professional Responsibilities of Engineers: The emerging consensus on the Responsibility for safety among engineers, Hazards and Risks. Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and reducing risk - Ethical standards vs. Professional conduct - Collegiality and Loyalty – Respect for Authority – Collective Bargaining –Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights –Employee Rights – Intellectual Property Rights (IPR) – Discrimination - Organizational complaint procedures - Government agencies - Resolving Employee concerns.

UNIT V

Ethics in Global Context and Global Issues: Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Sample Code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of Electronics and Telecommunication Engineers (IETE), India, etc.122.

TEXT BOOKS

1. Ethics in Engineering, Mike Martin and Roland Schinzinger, McGraw Hill. New York 1996.
2. Ethics in Engineering Practice and Research, Caroline Whitbeck, Elsevier.
3. Engineering Ethics, Govindarajan. M, Natarajan. S, Senthilkumar. V.S, Prentice Hall of India, 2004.

REFERENCES

1. Engineering Ethics, Charles D Fleddermann, Prentice Hall, New Jersey, 2004 (Indian Reprint).
2. Engineering Ethics Concepts and Cases, Charles E Harris, Michael S Pritchard and Michael J Rabins, Thompson Learning, United States, 2000 (Indian Reprint now available).
3. Ethics and the Conduct of Business, John R Boatright, Pearson Education, New Delhi, 2003.
4. Fundamentals of Ethics for Scientists and Engineers, Edmund G Seebauer and Robert L Barry, Oxford University Press, Oxford, 2001.
5. Ethics in Engineering, Fourth Edition, Mike W. Martin, Rolan Schinzinger, Mc Graw Hill publishers.
6. Engineering Ethics-An industrial Perspective, Gail Dawn Baura.
7. Ethics and Values in Industrial-Organizational Psychology, Joel Lefkowitz.

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

(5ME59) PRODUCTION TECHNOLOGY LABORATORY

(Common to ME & AE)

Course Prerequisite: Production Technology.

Course Objectives

- **Understand** and evaluate casting techniques and sand properties
- **Understand** different welding processes and their use
- **Understand** different press working operations
- **Understand** about the processing of plastics

Course Outcomes

After completion of the course the student is able to

- **Apply** the knowledge involved in casting techniques
- **Decide** the selection of various welding techniques applicable for different materials
- **Integrate** the knowledge involved in press working operations
- **Analyze** the techniques involved in processing of plastics

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

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. Brazing - 1 Exercise

MECHANICAL PRESS WORKING

1. Blanking and Piercing operations
2. Bending operation

PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

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0	3	2

(5ME60) HEAT AND MASS TRANSFER LABORATORY

(Common to ME & AE)

Course Prerequisites: Thermodynamics and Heat and Mass Transfer.

Course Objectives

- **Analyze** various modes of heat transfer experimentally.
- **Measure** heat transfer through conduction
- **Measure** heat transfer through natural and forced convection
- **Measure** heat transfer through radiation

Course Outcomes

After completion of the course the student is able to

- **Identify** and analyse the mode of heat transfer
- **Evaluate** thermal conductivity of lagged pipe , metal bar and insulating powder
- **Evaluate** Heat transfer coefficient for natural and forced convection
- **Evaluate** emissivity of the given metal

LIST OF EXPERIMENTS

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. To find out Critical Heat Flux
4. Determination of Overall Heat Transfer coefficient of Composite Wall.
5. Determination of thermal conductivity of Lagged Pipe.
6. Determination of Heat Transfer coefficient in Forced Convection Apparatus.
7. Determination of Heat Transfer coefficient in Natural Convection Apparatus.
8. Determination of Thermal Conductivity of Insulating Powder.
9. Determination of effectiveness of heat exchanger.
10. Measurement of Emissivity of given test plate .
11. Heat Transfer in Dropwise and Film Wise Condensation.
12. Determination of heat transfer coefficient and instantaneous heat transfer rate for Transient heat Conduction

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B.Tech. III Year II Semester

L	T/P/D	C
3	0	3

(5BS41) BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

(Common to CE, EEE, ME, ECE, CSE, EIE, IT & AE)

Course Prerequisites: Basic knowledge about Economics, Finance and Business**.**

Course Objectives

- **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
- **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
- **Describe** the features of different market structure and pricing strategies
- **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

After completion of the course the student is 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. Managerial Economics and Financial Analysis by Aryasri, Tata McGraw Hill, 2009.
2. Managerial Economics by Varshney & Maheswari, Sultan Chand, 2009.

REFERENCES

1. Financial Accounting for Management: An analytical perspective by Ambrish Gupta, Pearson Education, 2010.
2. Managerial Economics by H. Craig Peterson & W. Cris Lewis, Prentice Hall of India.

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L	T/P/D	C
3	1	4

(5AE07) AUTOMOBILE ENGINEERING DESIGN – II

Course Prerequisites: Mechanics of Materials, Engineering Design, Material science and Technical Drawing.

Course Objectives

- **Provide** bearing selection, materials and design
- **Design** of engine components and beams
- **Design** of power transmission elements and system
- **Understand** the design considerations for clutchs and brakes

Course Outcomes

After completion of the course the student is able to

- **Select** bearings, identify materials and design
- **Analyse** engine components and beams
- **Analyse** power transmission elements and system
- **Assess** the design considerations for clutchs and brakes

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 and bearing selection.

UNIT II

Engine Parts: Pistons, forces acting on piston, construction, design and proportions of piston, cylinder and 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 and overview of center cranks; crank pins and crank shafts.

Design of Vehicle Gear Box: 3-Speed gear box, 4-speed gear box and steering gear mechanism design.

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 and 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 and chain drives.

UNIT IV

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 and check for dynamic and wear considerations.

UNIT V

Clutches: Torque transmitting capacity, multi-disk clutches, friction materials, cone clutches, centrifugal clutches, energy equation and thermal considerations.

Brakes: Energy equations, block break with short shoe, block break and pivoted block break with long shoe, internal expanding break, band breaks, disk brakes and 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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L	T/P/D	C
3	0	3

(5AE08) VEHICLE DYNAMICS

Course Prerequisites: Engineering Physics and Engineering Mechanics

Course Objectives

- **Identify** the difference between static loads and dynamic loads on vehicle
- **Review** the performance of a vehicle in braking and acceleration
- **Assess** different road loads on vehicle
- **Provide** ride and handling concepts of a vehicle

Course Outcomes

After completion of the course the student is able to

- **Calculate** static loads and dynamic loads on vehicle
- **Evaluate** different braking and acceleration forces
- **Estimate** different road loads of a vehicle
- **Identify** difference between ride and handling of a vehicle

UNIT I

Introduction: Fundamental approach to modelling - lumped mass, vehicle fixed coordinate system, motion variables, earth fixed coordinate system, Euler angles, forces, newton's second law, dynamic axle loads - static loads on level ground, low-speed acceleration and loads on grades.

Acceleration Performance: Power-limited acceleration-engines, power train, automatic transmissions, traction-limited acceleration - transverse weight shift due to drive torque and traction limits.

UNIT II

Braking Performance: Constant deceleration, deceleration with wind resistance, energy/power, braking forces - rolling resistance aerodynamic drag, driveline drag, grade, brakes - brake factor, tire-road friction – velocity, inflation pressure, vertical load, brake proportionating, anti-lock braking systems, braking efficiency, rear wheel lockup and pedal force gain.

UNIT III

Road Loads: Aerodynamics - mechanics of air flow around a vehicle, pressure distribution on a vehicle, aerodynamic forces, drag components, aerodynamics aids - bumper spoilers, air

dams, deck lid spoilers, window and pillar treatments, optimization, drag - air density, drag coefficient, side force, lift force, pitching moment, yawing moment, rolling moment, crosswind sensitivity, rolling resistance - factors affecting rolling resistance, tire temperature, tire inflation pressure/load, velocity, tire material and design and tire slip.

UNIT IV

Ride: Excitation sources - road roughness, tire/wheel assembly, driveline excitation, engine/transmission, vehicle response properties - suspension isolation, suspension stiffness, suspension damping, active control, wheel hop responses, suspension nonlinearities, rigid body bounce/pitch motions and bounce pitch frequencies.

UNIT V

Handling: Introduction, low speed turning, high speed cornering - tire cornering forces and cornering equations, understeer gradient, characteristic speed, critical speed, lateral acceleration gain, yaw velocity gain, sideslip angle, static margin, suspension effects on cornering - roll moment distribution, camber change, roll steer, lateral force compliance steer, aligning torque, effect of tractive force on cornering and summery of under steer effects.

Introduction to simple roll models of rigid vehicle and suspended vehicle.

TEXT BOOK

1. Thomas D Gillespie, “Fundamentals of Vehicle dynamics”, SAE, USA, 1992.

REFERENCES

1. Wong J Y, “Theory of Ground Vehicles”, Ann Arbor, Michigan, USA, 1978.
2. Giri N K, “Automobile Mechanics”, 8th edition, Khanna Pub. 2008.

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L	T/P/D	C
3	0	3

(5AE09) MACHINE TOOLS AND METROLOGY

Course Prerequisites: Physics, Theory of Machines and Production Technology

Course Objectives

- **Understand** the basic concepts of metal cutting
- **Provide** working principles of different machines tools and their applications
- **Demonstrate** basic concepts of limits, fits and tolerances, selective assembly and Interchangeability
- **Appraise** working principles of various linear, angular, taper, screw thread, flat surface, surface roughness and optical measuring devices

Course Outcomes

Students should be able to

- **Apply** elementary knowledge of metal cutting to modeling and analysis of cutting forces, power in machining process
- **Work** on various machine tools to produce components
- **Use** limits, fits and tolerances
- **Work** with various measuring devices to measure linear, angular, surface texture measurements

UNIT I

Theory of Metal Cutting: Elements of cutting process, classification of cutting tools, geometry of single point tool, orthogonal cutting, chip formation and types of chips. Force relationships (Merchant's force circle), velocity relationships, cutting speed, feed, depth of cut. Tool wear and tool life, coolants, machinability and tool materials.

Engine Lathe: Principle of working, classification, specifications, parts, work holders, tool holders, lathe attachments, operations performed and machining time.

Overview on turret and capstan lathes and automatic lathes

UNIT II

Milling Machine: Principle of working, classification, specifications, features of horizontal, vertical and universal milling machines, milling cutters, operations performed, overview on indexing and machining time.

Shaping, Slotting and Planning Machines: Principle of working, parts, specifications, classification, operations performed.

Drilling and Boring Machines: Principle of working, parts, specifications, classification and operations performed.

UNIT III

Grinding Machine: Fundamentals, classification, types of abrasives, bonds, specifications of a grinding wheel.

Introduction to Super Finishing Operations: lapping, honing and broaching and comparison to grinding.

Introduction to jigs and fixtures.

Systems of Limits and Fits: Introduction, normal size, tolerances, limits, deviations, allowances, fits and their types, unilateral and bilateral tolerance system, hole and shaft basis systems. Interchangeability and selective assembly. Introduction to standard systems.

Linear Measurement: Length standard, line and end standards - slip gauges, dial indicator, vernier caliper and micrometer.

Measurement of Angles and Tapers: Bevel protractor, slip gauges, spirit level and sine bar.

Flat Surface Measurement: Instruments used - straight edges and surface plates.

UNIT IV

Limit Gauges: Taylor's principle – Design of Go and No Go gauges, plug, ring, snap, gap and taper gauges.

Surface Roughness Measurement: Differences between surface roughness and surface waviness, numerical assessment of surface finish – CLA, Ra, R.M.S and Rz. Methods of measurement of surface finish – Profilograph.

Optical Measuring Instruments: Tool maker's microscope and optical projector - its uses.

Overview on measurement through comparators

UNIT V

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

Gear Measurement: Measuring instruments, Gear tooth profile - Measurement of diameter, pitch, pressure angle and tooth thickness.

TEXT BOOKS

1. Manufacturing Technology (Volume 2) - Metal Cutting and Machine Tools by P N Rao, Tata McGraw Hill.
2. Engineering Metrology by Mahajan.
3. Production Technology by R.K. Jain and S.C. Gupta.

REFERENCES

1. Manufacturing Engineering and Technology by Kalpakjian, Wesley.
2. Elements of Workshop Technology Vol. I and II, by Hajara Chowdhary, Indian Book Distributors, Calcutta.
3. Production Technology by H.M.T. (Hindustan Machine Tools).
4. Engineering Metrology by R.K. Jain, Khanna Publishers.
5. Precision Engineering in Manufacturing by RL Murthy, New Age.

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Open Elective II	**3**	**0**	**3**

(5CE72) INTRODUCTION TO GEOGRAPHICAL INFORMATION SYSTEM

Course Objectives

- **Describe** and define various concepts of Remote Sensing and GIS
- **Enable** the students to analyze data using GIS
- **Make** the students appraise the importance of accuracy in GIS
- **Enable** the students to apply GIS knowledge in solving various problems in real world scenario

Course Outcomes

After completion of the course the student is able to

- **Describe** different concepts and terms used in GIS
- **Compare** and process different data sets
- **Evaluate** the accuracy and decide whether a data set can be used or not
- **Demonstrate** various applications GIS

UNIT I

Introduction to GIS: Introduction, History of GIS, GIS Components, GIS Applications in Real life, The Nature of geographic data, Maps, Types of maps, Map scale, Types of scale, Map and Globe, Co-ordinate systems, Map projections, Map transformation, Geo-referencing,

UNIT II

Spatial Database Management System: Introduction: Spatial DBMS, Data storage, Database structure models, database management system, entity-relationship model, normalization

Data models and data structures: Introduction, GIS Data model, vector data structure, raster data structure, attribute data, geo-database and metadata,

UNIT III

Spatial Data input and Editing: Data input methods – keyboard entry, digitization, scanning, conversion of existing data, remotely sensed data, errors in data input, Data accuracy, Micro and Macro components of accuracy, sources of error in GIS.

Spatial Analysis: Introduction, topology, spatial analysis, vector data analysis, Network analysis, raster data analysis, Spatial data interpolation techniques

UNIT IV

Implementing a GIS: Awareness, developing system requirements, evaluation of alternative systems, decision making using GIS.

Advanced GIS: WebGIS concept**,** webGIS fundamentals, Potential of web GIS, Server side strategies, client side strategies, mixed strategies and webGIS applications

UNIT V

Applications of GIS: GIS based road network planning, Shortest path detection using GIS, Hazard Zonation using remote sensing and GIS, GIS for solving multi criteria problems, GIS for business applications and Mineral mapping using GIS.

TEXT BOOKS

1. Introduction to Geographic Information systems by Kang-tsung Chang, McGrawHill Education (Indian Edition), 7th Edition, 2015.
2. Fundamentals of Geographic Information systems by Michael N. Demers, 4th Edition, Wiley Publishers, 2012.

REFERENCES

1. Remote Sensing and GIS by Basudeb Bhatta, Oxford University Press, 2nd Revised Edition, 2011.
2. Geographic Information systems – An Introduction by Tor Bernhardsen, Wiley India Publication, 3rd Edition, 2010.
3. Textbook of Remote Sensing and Geographical Information systems by M.Anji Reddy, B.S.Publications, 4th Edition, 2012.
4. Textbook of Remote Sensing and Geographical Information systems by Kali Charan Sahu, Atlantic Publishers and Distributors, 1st Edition, 2007.

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B.Tech. III Year II Semester	**L**	**T/P/D**	**C**
Open Elective II	**3**	**0**	**3**

(5EE72) ENERGY AUDITING CONSERVATION AND MANAGEMENT

Course Objectives

- **Understand** the necessity of conservation of Energy
- **Know** the methods of Energy management
- **Identity** the factors to increase the efficiency of electrical equipment
- **Know** the benefits of carrying out energy Audits

Course Outcomes

After completion of the course the student is able to

- **Conduct** Energy Audit of industries
- **Manage** energy Systems
- **Specify** the methods of improving efficiency of electric motor
- **Improve** power factor and to design a good illumination system
- Calculate pay back periods for energy saving equipment

UNIT I

Basic Principles of Energy Audit: Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station and building energy audit.

UNIT II

Energy management: Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manager, Qualities and functions, language, Questionnaire - check list for top management

UNIT III

Energy Efficient Motors: Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

UNIT IV

Power Factor Improvement, Lighting and Energy Instruments: Power factor – methods of improvement, location of capacitors, p.f with non-linear loads, effect of harmonics on p.f. , p.f motor controllers - Good lighting system design and practice, lighting control, lighting energy

audit - Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, flux meters, tongue testers and application of PLC's

UNIT V

Economic Aspects and Analysis: Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis-Energy efficient motors- calculation of simple payback method, net present worth method-Power factor correction, lighting - Applications of life cycle costing analysis and return on investment.

REFERENCES

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Heinemann publications.
2. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998.
3. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995.
4. 4) Energy management handbook by W.C.Turner, John wiley and sons.
5. Energy management and good lighting practice: fuel efficiency- booklet12-EEO.

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B.Tech. III Year II Semester	**L**	**T/P/D**	**C**
Open Elective II	**3**	**0**	**3**

(5ME72) OPTIMIZATION TECHNIQUES

Course Objectives

- **Understand** the classification of optimization techniques and its practical use
- **Understand** about the optimization of one dimensional optimization methods
- **Knows** about constrained minimization methods
- **Understands** Geometric and dynamic programmings

Course Outcomes

After completion of the course the student is able to

- **Apply** the different types of optimization techniques for different purposes
- **Formulate** and solve the problems by using one dimensional unconstrained minimization methods
- **Formulate** and solve the problems (industrial/research) by using the geometric programming
- **Formulate** and solve the industrial problems by using the dynamic programming methods

UNIT I

Introduction: Engineering Applications; Statement of the Optimal Problem: Classification; Optimization Techniques. Classical Methods: Single Variable Optimization; Multivariable Optimization without any Constraints with Equality and Inequality Constraints.

UNIT II

One-Dimensional Minimization Methods: Uni-model Function; Elimination Methods – Dichotomous Search, Fibonacce and Golden Section Methods; Interpolation Methods – Quadratic and Cubic Interpolation Methods.

UNIT III

Unconstrained Minimization Methods: Univariate, Conjugate Directions, Gradient and Variable Metric Methods. *Constrained Minimization Methods*: Characteristics of a constrained problem; Direct Methods of feasible directions; Indirect Methods of interior and exterior penalty functions.

UNIT IV

Geometric Programming: Formulation and Solutions of Unconstrained and Constrained geometric programming problems.

UNIT V

Dynamic Programming: Concept of Sub-optimization and the principle of optimality; Calculus, Tabular and Computational Methods in Dynamic Programming; An Introduction to Continuous Dynamic Programming.

TEXT BOOKS

1. Optimization (Theory & Applications) – S.S. Rao, Wiley Eastern Ltd., New Delhi.
2. Optimization Concepts and Applications in Engineering - Ashok D.Belegundu and Tirupathi R Chandrupatla -- Pearson Education.

REFERENCES

1. Optimization: Theory and Practice, C.S.G. Beveridge and R.S. Schechter, MGH, New York.
2. Genetic Algorithms in search, Optimization and Machine, Goldberg D. E., Addison-Wesley-NewYork.
3. Optimization for Engineering Design Algorithms and Examples, Kalyanamoy Deb, Prentice Hall of India.

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B.Tech. III Year II Semester	**L**	**T/P/D**	**C**
Open Elective II	**3**	**0**	**3**

(5EC72) INTRODUCTION TO MICRO PROCESSORS AND CONTROLLERS

Course Objectives

- **Differentiate** various number systems
- **Develop** simple application using 8085 microprocessors
- **Develop** simple applications using 8051 microcontrollers

Course Outcomes

After completion of the course the student is able to

- **Understand** basic computing concepts
- **Know** architecture of 8085 micro processors and 8051 Microcontrollers
- **Interface** peripherals to microprocessor
- **Program** internal resources of 8051 microcontroller

UNIT I

Introduction to Computing: Numbering and Coding Systems: Binary, Decimal, Hexadecimal and conversions, Binary and Hexadecimal Arithmetic, Complements, Alphanumeric codes. Digital Premier and Inside the Computer.

UNIT II

8085 Microprocessor: Features, Architecture and operation of 8085, Programming Model, External Memory for 8085.

UNIT III

Programmable Peripheral Devices: Programmable Peripheral Interface (8255), USART (8251), Programmable Interval Timer (8253) and interfacing.

UNIT IV

8051 Microcontrollers: Microcontrollers and Embedded Processors, Overview of the 8051 family, Architecture and Programming Model of 8051, Timers and Counters, parallel and serial ports, Interrupts, Special Function Register formats and Internal Memory Organization.

UNIT V

Applications: 8051 Programming in C: Data types for the 8051, programs for IO operations, programs on Timer operations, Serial IO ports, and interrupts and Case Study: DC Motor Control

TEXT BOOKS

1. Microprocessor Architecture, Programming and Applications with the 8085/8080A, Gaonkar
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C, 2nd Edition, Muhammad Ali Mazidi,Janice Gillispie Mazidi, Rolin D. McKinlay

REFERENCES

1. The 8051 Microcontroller : programming, architecture by Ayala & Gadre, Cengage Publications
2. Digital Design – Morris Mano, PHI, 3rd Edition, 2006.

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III Year B.Tech II Sem	**L**	**T/P/D**	**C**
Open Elective - II	**3**	**0**	**3**

(5EC95) WIRELESS COMMUNICATIONS AND NETWORKS

Prerequisite: Computer Networks

Course Objectives:

- Understand fundamentals of wireless communications
- Know basics of wireless networks
- Differentiate fixed IP and Mobile IP
- Learn design of basic wireless LAN network

Course outcomes:

After Completion of the course the student is able to

- Understand the fundamental concepts of Cellular communications
- Differentiate various multiple access techniques
- Learn wireless protocols used in wireless Networks
- Understand mobile IP requirements

UNIT I

WIRELESS COMMUNICATIONS & SYSTEM FUNDAMENTALS:

Introduction to wireless communications systems, examples, comparisons & trends. Cellular concepts-frequency reuse, strategies, interference & system capacity, trunking and grade of service, improving coverage &capacity in cellular systems.

UNIT II

MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION:

FDMA, TDMA, SSMA (FHMA/CDMA/Hybrid techniques), SDMA technique (AS applicable to wireless communications). Packet radio access-protocols, CSMA protocols ,reservation protocols ,capture effect in packet radio , capacity of cellular systems .

UNIT III

WIRELESS NETWORKING:

Introduction, differences in wireless & fixed telephone networks, traffic routing in wireless networks – circuit switching, packet switching X.25 protocol. Wireless data services – cellular digital packet data (CDPD), advanced radio data information systems, RAM mobile data (RMD). Common channel signaling (CCS), ISDN-Broad band ISDN & ATM, Signalling System no .7(SS7)-protocols, network services part, user part, signaling traffic, services and performance.

UNIT IV

MOBILE IP AND WIRELESS APPLICATION PROTOCOL:

Mobile IP Operation of mobile IP, Co-located address, Registration, Tunneling, WAP Architecture, overview, WML scripts, WAP service, WAP session protocol, wireless transaction, Wireless datagram protocol.

UNIT V

WIRELESS LAN TECHNOLOGY:

Infrared LANs, Spread spectrum LANs, Narrow bank microwave LANs, IEEE 802 protocol Architecture, IEEE802 architecture and services, 802.11 medium access control, 802.11 physical layer.

BLUE TOOTH: Overview, Radio specification, Base band specification, Links manager Specification, Logical link control and adaptation protocol. Introduction to WLL Technology.

TEXTBOOKS:

1. Wireless Communication and Networking – William Stallings, PHI, 2003.
2. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, PHI, 2nd Edn.,2002.
3. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy,Pearson Education, 2002.

REFERENCES:

1. Wireless Digital Communications – Kamilo Feher, PHI, 1999Page 26 of 38

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B.Tech. III Year II Semester	**L**	**T/P/D**	**C**
Open Elective II	**3**	**0**	**3**

(5CS72) OPEN SOURCE TECHNOLOGIES

Course Objectives

- **Understand** Perl, Python, PHP and Ruby to new situations and learn from the experience
- **Assist** Perl programmer or database administrator to compile large programming set
- **Incorporate** PHP into HTML files, Write basic PHP scripts, Process form input, Write and use functions
- **Apply** advanced techniques, tools, and methodologies that can be used to build complex, scalable, PHP applications

Course Outcomes

After completion of the course the student is able to

- **Apply** regular expressions to tokenize and validate data in a variety of languages
- **Utilize** Ruby to solve a wide range of text processing problems
- **Understand** the nuances and differences in a web based environment as compared to more traditional environments
- **Distinguish** variety of languages to develop interactive web applications

UNIT I

Introduction to PERL: Scripts and Programs, Origin of Scripting, Scripting Today, Characteristics of Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines, advance Perl - finer points of looping, pack and unpack, file system, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming and security Issues.

UNIT II

PHP Basics: PHP Basics- Features Embedding PHP Code in your Web pages, Outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures . Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

UNIT III

Advanced PHP Programming: PHP and Web Forms, Files, PHI3 Authentication and Methodologies -Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHI3, Sending Email using PHP, PHI3Encryption Functions, the Merypt package, Building Web sites for the World - Translating Websites- Updating Web sites Scripts, Creating the Localization Repository, Translating Files, text. Generate Binary Files, Set the desired language within your scripts. Localizing Dates, Numbers and Times.

UNIT IV

Python: Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python, Exception Handling, Integrated Web Applications in Python - Building Small, Efficient Python Web Systems ,Web Application Framework.

UNIT V

Ruby: Basics of Ruby, classes, objects and variable, arrays, Exception Handling, threads, Regular Expressions, Strings and Objects in Ruby.

TEXT BOOKS

1. Programming Perl Larry Wall, T.Christiansen and J.Orwant, O'Reiily, SPD.
2. Guide to Programming with Python, M.Dawson, Cengage Learning.
3. The Ruby Programming Language 1st Edition by David Flanagan.
4. Professional PHP Programming by Jesus M. Castagnetto , Harish Rawat , Deepak T. Veliath (WROX publication).

REFERENCES

1. Perl Power, J.P.Flynt, Cengage Learning.
2. Perl by Example, E, Quigley, Pearson Education.
3. Programming Ruby: The Pragmatic Programmer's Guide, by Pragmatic Dave Thomas, Andy Thomas.
4. Professional PHP6 by WROX publication.

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B.Tech. III Year II Semester	**L**	**T/P/D**	**C**
Open Elective II	**3**	**0**	**3**

(5EI72) LABVIEW PROGRAMMING

Course Objectives

- **Understand** the new concept in measurement and automation
- **Understand** how to control an external measuring device by interfacing a computer
- **Competent** in data acquisition and instrument control
- **Program** for networking and other applications like Digital image processing control system and signal processing

Course Outcomes

After completion of the course the student is able to

- **Develop** a Virtual Instrument using LabVIEW to communicate with real world
- **Identify** salient traits of a virtual instrument and incorporate these traits in their projects
- **Experiment**, analyze and document in the laboratory prototype measurement
- **Develop** program for application like networking, Digital image processing, control system, etc.

UNIT I

Virtual Instrumentation: Historical perspective, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI and Active X Programming.

UNIT II

Structures and Sequence: Controlling program execution with structures: While and For loops, Shift registers, Case and Sequence structure and Sub VI

UNIT III

Composite Data and Displays: Arrays and Structures: Two dimension array, Auto Indexing to set the for loop count, Building arrays with auto indexing, Array Acrobats, Polymorphism, Cluster Order, Cluster to pass data, Bundling and unbundling cluster, Interchangeable arrays and cluster , Error Cluster and Error handling functions: Chart update modes, Single Plot chart, Wiring multiple plot chart, Single Plot verus Multiple plot data types, The X scroll bar, clearing the chart, Stacked and overlaid plots, Multiple Y scales and chart history lengths.:

Activity: Temperature monitor, Graphing a sine wave, XY plot to plot a circle, Temperature analysis and 3D graphs.

UNIT IV

Strings, File output and Signal Measurements and Generation: Single line strings, online string updation, Scroll bar, Writing and reading a measurement file,Writing and reading from a spread sheet,Computer to real world interface using LabVIEW, Creating Ni DAQ Task in Measurement and Automation Explorer (MAX), Generating code from MAX, DAQ timing and trigger, Multichannel and continuous acquisition, Streaming Data file and Counting frequency and events.VI Chassis requirements. Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB.

UNIT V

Applications: Networking basics for office & Industrial applications, VISA and IVI, VI toolsets, Distributed I/O modules, Development of Control system, Industrial Communication, Image acquisition and processing,

TEXT BOOKS

1. Gary Johnson, LabVIEW Graphical Programming, 2nd edition,McGraw Hill, Newyork, 1997.
2. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey, 1997.

REFERENCES

1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes,2000.
2. Rick Bitter ,LabVIEW advanced programming technique, 2nd Edition, CRC Press,2005
3. Jovitha Jerome, Virtual Instrumentation using LabVIEW, 1st Edition, PHI, 2001.

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III Year B.Tech II Sem	**L**	**T/P/D**	**C**
Open Elective - II	**3**	**0**	**3**

(5EI79) FUNDAMENTALS OF ROBOTICS

Course Objectives

The course is intended for students to:

- Understand the Robot coordinate system and control system
- Learn different types of Robot sensors and actuators
- Identify different types of Robot grippers and their applications.
- Acquire Knowledge on kinematics and vision systems used for different Robots

Course Outcomes

After completion of the course the student is able to:

- Gain knowledge about basic concepts of robots.
- Appreciate the usage of different actuators, sensors and grippers in Robotics.
- Analyze the direct and the inverse kinematic problems.
- Able to identify the applications of Machine Vision in Robotics.

UNIT I:

Basic Concepts:

An over view of Robotics, classification of Robots, Robot Components, Robot degrees of freedom, Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot Characteristics.

UNIT II:

Sensors:

Sensor characteristics, Position sensors, Velocity sensors, Acceleration sensors, Force and Pressure sensors, Torque sensors, Microswitches, Light and infrared sensors, Touch and tactile sensors, Proximity sensors, Range finders.

Unit III:

Actuators and Grippers:

Characteristics of actuating system, Comparison of actuating systems, Hydraulic actuators, Pneumatic devices, Electric motors, Magneto-strictive actuators, Shape-Memory Metals, Electro-active Polymer Actuators.

Classification of Grippers, Drive system for Grippers, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks and Scoops, Gripper Force analysis and design, Active and Passive Grippers.

UNIT IV:

Kinematics:

Robots as Mechanisms, Matrix Representation, Homogeneous Transformation Matrices, Representation of Transformations, Inverse of Transformation Matrices, Forward and Inverse Kinematics with Equations.

UNIT V:

Vision:

Image acquisition, Illumination Techniques, Imaging Geometry, Basic Relationships between Pixels, Segmentation, Description, Segmentation and Description of 3-D Structures, Recognition, Interpretation.

TEXT BOOKS

1. Saeed B. Niku ,Introduction To Robotics : Analysis, Control, Applications ,Wiley, 2nd Edition .
2. Deb.S.R, "Robotics technology and flexible Automation", John Wiley

REFERENCES

1. Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, "Industrial Robotics, Technology programming and Applications", McGraw Hill, 2012.
2. K.S.Fu, R.C.Gonzalez, C.S.G Lee, "Robotics- Control ,Sensing ,Vision and Intelligence ",McGraw-Hill International Edition.
3. Klafter. R.D, Chimielewski. T.A, Negin. M, "Robotic Engineering–An integrated approach", Prentice Hall of India, New Delhi

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B.Tech. III Year II Semester	**L**	**T/P/D**	**C**
Open Elective II	**3**	**0**	**3**

(5IT72) RELATIONAL DATABASE MANAGEMENT SYSTEMS

Course Objectives

- **Describe** database management systems (DBMS) concepts and relational data model
- **Employ** DBMS concepts to organize, maintain and retrieve information efficiently and effectively from a DBMS
- **Discuss** the concepts of transactions and transaction processing systems
- **Examine** the issues and techniques relating to concurrency and recovery in multi-user database environments

Course Outcomes

After completion of the course the student is able to

- **Describe** the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation
- **Employ** the Relational Database Model to understand the Logical and Physical aspects of the DBMS architecture
- **Analyse** and apply normal forms for real time database applications.
- **Evaluation** of transaction properties and file organization methods

UNIT I

Introduction to Databases and Database Management System - Database system Applications - Advantages of DBMS over File System - Data Models – Instances and schema - View of Data - Database Languages -DDL-DML - Database Users and Administrator - Database System Structure.

UNIT II

Database Design and ER diagrams – Attributes and Entity Sets – Relationships and Relationship Sets – Constraints - Keys - Design Issues - Entity-Relationship Diagram- Weak Entity Sets - Extended E-R Features - Database Design with ER model - Database Design for Banking Enterprise

UNIT III

Introduction to the Relational Model – Structure of RDBMS - Integrity Constraints over Relations – Enforcing Integrity Constraints – Querying Relational Data - Relational Algebra and Calculus.

Introduction to SQL- Data Definition commands, Data Manipulation Commands, Basic Structure, Set operations Aggregate Operations - Join operations - Sub queries and correlated queries, SQL functions , views ,Triggers, Embedded SQL.

UNIT IV

Functional Dependencies– Introduction , Basic Definitions, Trivial and Non trivial dependencies, closure of a set of dependencies, closure of attributes, irreducible set of dependencies- Schema Refinement in Database Design- Problems Caused by Redundancy – Decompositions – Problem Related to Decomposition –- Lossless Join Decomposition – Dependency Preserving Decomposition - FIRST, SECOND, THIRD Normal Forms – BCNF –– Multi valued Dependencies – Fourth Normal Form.

UNIT V

Transaction concept- Transaction state- Implementation of atomicity and Durability- Concurrent executions – Serializability, Recoverability

File Organization – Organization of records in file - Data Dictionary Storage – Indexing and Hashing – Basic Concepts , Ordered Indices,B^+Tree Index files, B- tree index files.

TEXT BOOKS

1. Database System Concepts, Silberschatz, Korth , Fifth Edition, McGraw hill.
2. Introduction to Database Systems, C.J.Date, Pearson Education.

REFERENCES

1. Fundamentals of Database Systems, Elmasri Navrate Pearson Education.
2. Database Management Systems, Raghu ramakrishnan, Johannes Gehrke, TATA Mc Graw Hill.
3. Data base Systems design, Implementation, and Management, Peter Rob and Carlos Coronel 7th Edition.
4. Data Base Systems using Oracle: A simplified guide to SQL and PL /SQL, Shah, PHI.

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B.Tech. III Year II Semester	**L**	**T/P/D**	**C**
Open Elective II	**3**	**0**	**3**

(5AE72) MODERN AUTOMOTIVE TECHNOLOGIES

Course objectives

- **Provide** an overview on advanced engine control system concepts
- **Study** the concepts and drivetrain configurations of electric and hybrid electric vehicles
- **Present** principle, working and automotive applications of fuel cell and solar technology
- **Aware** of intelligent vehicle technologies like navigation, safety, security and comfort systems

Course Outcomes

After completion of the course the student is able to

- **Apply** advanced engine control system concepts in engineering
- **Discuss** electric and hybrid electric drivetrain technologies and drivetrain components
- **Describe** automotive applications of fuel cell and solar technology
- **Appreciate** the technological advancements driver assistance systems

UNIT I

Advanced Engine Controls: Concept of an electronic engine control system, electronic fuel injection - throttle body fuel injection, multi point fuel injection, gasoline direct injection, common rail direct injection, electronic ignition control, engine mapping, on-board diagnostics – engine control module and powertrain control module.

UNIT II

Electric and Hybrid Vehicles: Electric vehicles - Layout of an electric vehicle, performance, energy consumption, advantage and limitations. Hybrid electric vehicles - Concepts, types of hybrid drive train architecture, merits and demerits.

UNIT III

Fuel Cell and Solar Vehicles: Fuel cell vehicle – Operating principle, types of fuel cells, fuel cell options for fuel cell vehicle and fuel cell hybrid vehicle. Solar vehicle - Solar photovoltaic cell, solar array, solar car electrical system and drive train.

UNIT IV

Telematics and Comfort Systems: Global positioning system, geographical information systems, navigation system, automotive vision system, adaptive cruise control system, active suspension system, power steering and power windows.

UNIT V

Safety and Security Systems: Active and passive safety, airbags, seat belt tightening system, collision warning systems, anti lock braking systems, traction control system, electronic immobilizers, remote keyless entry, smart card system, number plate coding.

TEXT BOOKS

1. William B Ribbens, “Understanding Automotive Electronics”, 5th edition, Butter worth Heinemann Woburn,1998.
2. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2005.

REFERENCES

1. “Automotive Hand Book” Robert Bosch, SAE, 5th edition, 2000.
2. Iqbal Husain, “Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
3. Ljubo Vlacic, Michel Parent and Fumio Harashima, “Intelligent Vehicle Technologies”, Butterworth-Heinemann publications, Oxford, 2001.
4. “Navigation and Intelligent Transportation Systems – Progress in Technology”, Ronald K Jurgen, Automotive Electronics Series, SAE, USA, 1998.

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B.Tech. III Year II Semester	**L T/P/D C**
Open Elective II	**3 0 3**

(5BS72) ENTREPRENEURSHIP

Course objectives

- **Introduce** basics of entrepreneurship development and the skills set required for innovation
- **Understand** changing business trends to enhance decision making skills.
- **Learn** analytical and conceptual skills of identifying opportunities and check on their feasibility for start-ups
- **Motivate** the engineers to choose entrepreneurship as a career for personal and societal growth

Course Outcomes

After completion of the course the student is able to

- **Identify** business opportunities and equip themselves in preparing business plans
- **Analyze** and evaluate different proposals and its requirements for start-ups
- **Pitch** the ideas to launch their own venture
- **Assess** the impact of competition and find methods to overcome the problems in business

UNIT I

Entrepreneurial Skills-Opportunities: Entrepreneurship as a career, Personality and Skill Set of Entrepreneur, The Wisdom of Five WHY's and in action, Value and Growth-Stories of Successful Enterprises.

Innovation and Entrepreneurship: Three Learning Milestones of Innovation: Use of Minimum Viable Product-Start-ups must tune the baseline towards the ideal-Pivot or Persevere.

UNIT II

Changing Business Environment-Role of Entrepreneur: The Role of Quality and Design, Beyond "The right place at the right time", Current trends in Business, Entrepreneurial Management.

UNIT III

Origins of Lean Start-up-Business Plans: The Concept of Vision to Steering: From Start-Define-Learn-Experiment to Leap-Test-Measure-Pivot.

UNIT IV

Validation of Projects and Products: Projects Evaluation by Budgeting Techniques, Value vs Waste, Analogs and Antilogs, Analysis Paralysis, Why first products are not meant to be perfect-Experiences, Forecasting and Experimenting of Products.

UNIT V

Start-up Methods and Understanding Competition: Accelerating Start-up's, optimization versus learning, Kanban Diagram of work as it progresses from stage to stage, the value of three A's: Actionable, Accessible and Auditable, Engines of growth to determine product/market fit, adopting smaller batches, reasons for Failures in Start-up's, Pricing Strategies Based On Competition

TEXT BOOKS

1. Eric Ries, "The Lean Startup", Crown Business, New York. v.3.1.
2. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001.
3. S.S. Khanka, Entrepreneurial Development, S. Chand and Company Limited, New Delhi, 2001.

REFERENCES

1. Mathew Manimala, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra ,2nd Edition ,2005
2. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 1996.
3. P.Saravanavel, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai - 1997.
4. Arya Kumar. Entrepreneurship. Pearson. 2012
5. Donald F Kuratko, T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning. 2012

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Year II Semester

L	T/P/D	C
0	3	2

(5ME61) MACHINE TOOLS AND METROLOGY LABORATORY

(Common to ME & AE)

Course Prerequisite: Machine tools, Metrology and Engineering Materials

Course Objectives

- **Remember** the working principles of various machine tools and their accessories
- **Remember** the significance of operating parameters and selection of cutting tools for performing machining operations
- **Familiarize** the calibration and measurement process
- **Impart** the knowledge on characteristics of measuring instruments

Course Outcomes

After completion of the course the student is able to

- **Perform** various operations on various machine tools
- **Choose** the appropriate cutting tools for various machining operations
- **Measure** the tolerances attained in different machining operations
- **Perform** analysis on the data attained from measuring instruments

MACHINE TOOLS: Any Six experiments

1. Introduction of general purpose machines - Lathe, drilling machine, milling machine, shaper, 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 surface grinding machine.
9. Exercise on grinding of tool angles.

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 lengths, heights, diameters by vernier calipers micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, Vernier calipers and checking the chordal addendum and chordal height of spur gear.
4. Machine tool alignment test on a lathe.
5. Machine tool alignment test on a milling machine.
6. Tool makers microscope and its application
7. Angle and taper measurements by bevel protractor, sine bars, etc.
8. Use of spirit level in finding the flatness of surface plate.
9. Thread measurement by two wire/ three wire method or tool makers' microscope.
10. Surface roughness measurement by TalySurf.
11. Surface wear resistances test using electro spark coating device.

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(5BS03) ADVANCED ENGLISH COMMUNICATION SKILLS LABORATORY

(Common to CE, EEE, ME, ECE, CSE, EIE, IT & AE)

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 gear their writing to the target audience
- **Groom** students to speak accurately and fluently and prepare them for real world activities through behavioral skills
- **Train** students in soft skills through role play and group discussion to improve their EQ

Course Outcomes

After completion of the course the student is 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
- **Negotiate** terms, manage complex situations through interpersonal skills, persuade people and make quick decisions

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.

UNIT I

- Oral Communication :Talking About Yourself
- Applications and Covering letters
- Resume Writing
- Verbal Ability: Vocabulary (Technical and Non-Technical) reading and listening (analysis and reasoning)

UNIT II

- Oral Communication: Making Presentations
- Writing an SOP
- Summarizing and Synthesizing Information

UNIT III

- Oral Communication: Group Discussions
- Writing Abstracts

UNIT IV

- Oral Communication : Debate
- Writing Reports

UNIT V

- Soft Skills

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).

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

(5AE52) AUTOMOBILE ENGINEERING LABORATORY

Course Prerequisites: Automotive Engine operation and Working of Engine systems

Course Objectives

- **Study** of automotive systems and subsystems
- **Demonstrate** the assemble and dismantle of engine and other subsystems
- **Know** the principle and functionality of automotive subsystems
- **Inspection** and measurement of different parameters

Course Outcomes

After completion of the course the student is able to

- **Explain** about automotive systems and subsystems
- **Assemble** and dismantle petrol and diesel engine and other subsystems
- **Discuss** the principle and functionality of automotive subsystems
- **Identify** the faults and measurement of different parameters

LIST OF EXPERIMENTS (Any ten experiments)

1. Valve spring testing and connecting rod alignment.
2. Dismantling, inspection and assembling of multi-cylinder petrol engine.
3. Dismantling inspection and study of multi-cylinder diesel engine.
4. Study, dismantling and assembling of clutch
5. Study, dismantling and assembly of differential unit
6. Study, dismantling and assembly of brake system
7. Study, dismantling and assembly of suspension system
8. Dismantling, inspecting and assembling of sliding mesh gear box and finding out the gear ratios.
9. Dismantling, inspecting and assembling of constant mesh gear box and finding out the gear ratios.
10. Dismantling, inspecting and assembling of synchromesh gear box and finding out the gear ratios.
11. Dismantling, inspection and assembling of steering gear box and finding out the gear ratios.
12. Study, dismantling and assembling of front and rear axle.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year I Semester **L T/P/D C**
3 0 3

(5AE10) ELECTRIC AND HYBRID VEHICLES

Course Prerequisites: Basic Electrical and Electronics Engineering.

Course Objectives

- **Study** the concepts and drivetrain configurations of electric drive vehicles
- **Provide** different electric propulsion systems and energy storage devices
- **Explain** the technology, design methodologies and control strategy of electric drive vehicles
- **Emphasize** on solar and fuel cell applications in automobiles

Course Outcomes

After completion of the course the student is able to

- **Understand** the concepts and drivetrain configurations of electric drive vehicles
- **Present** different electric propulsion systems and energy storage devices
- **Discuss** the technology, design methodologies and control strategy of electric drive vehicles
- **Appreciate** the solar and fuel cell applications in automobiles

UNIT I

Electric Vehicles: Layout of an electric vehicle, performance of electric vehicles, traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations, specifications, system components and electronic control system.

UNIT II

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 III

Electric Propulsion Systems: DC motor drives, Induction motor drives, permanent magnet brushless DC motor drives and switched reluctance motor drives.

UNIT IV

Motor Controllers and Control Systems: Control system principles, speed and torque control – DC motors and AC motors.

UNIT V

Energy Storages: Electromechanical batteries - Types of batteries, lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency and ultracapacitors.

TEXT BOOKS

1. Mehrdad Ehsani, Yimin Gao, sebastien E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRS Press, 2004.
2. James Larminie and John Loury, “Electric Vehicle Technology-Explained”, John Wiley & Sons Ltd., 2003.

REFERENCES

1. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Butterworth –Heinemann, 2002.
2. Ronald K Jurgen, “Electric and Hybrid – Electric Vehicles”, SAE, 2002.
3. Ron Hodkinson and John Fenton, “Light Weight Electric/Hybrid Vehicle Design”, Butterworth-Heine.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year I Semester

L	T/P/D	C
3	1	4

(5AE11) INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

Course Prerequisites: Engineering Mathematics

Course Objectives

- **Formulation and solution** using linear programming
- **Solve** transportation, sequencing, replacement and queuing problems
- **Understand** the role and application of industrial engineering
- **Explain** the theory of games, replacement and inventory and their solution methodology for solving problems

Course Outcomes

After completion of the course the student is able to

- **Analyse** linear programming models in practical and their practical use.
- **Evaluate** transportation, sequencing, replacement and queuing problems and their solution methodology
- **Appreciate** the role and application of industrial engineering
- **Apply** theory of games, replacement and inventory models for solving problems

UNIT I

Introduction: Origin, development, definition, characteristics and phases, types of OR models, applications and limitations.

Allocation: Linear programming problem formulation, graphical solution, simplex method, artificial variables technique, two phase method, big-M method and 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 and 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*2and 2*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

Marketing: Functions of marketing, marketing mix, product life cycle, channels of distribution and sales management. Manufacturing planning - MRP, MRP-II, JIT and CIM.

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 and SIMO Chart. Work Measurement - Stop watch procedure of time study, performance rating, allowances, work sampling and simple problems.

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. Introduction to OR by Taha; Publisher: Prentice Hall International.
3. Operations Research by Wagner; Publisher: Prentice Hall International.
4. Operations Research by S.D.Sharma-Kedarnath.
5. Introduction to O.R by Hiller and Liebermann; Publisher: Tata McGraw Hill.
6. Industrial Engineering Management, by Dr. O. P .Khanna.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year I Semester

L	T/P/D	C
3	0	3

(5ME16) CAD/CAM

(Common to ME & AE)

Course Prerequisites: Engineering Graphics, Engineering Design and Production Technology

Course Objectives

- **Understand** the mathematics behind the transformations and projections in design of products on CAD devices
- **Know** the various types of modeling and drafting
- **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

After completion of the course the student is able to

- **Select** the types of computer devices and solve the problems on transformations and use them in CAD software
- **Compare** the different types of models and perform drafting
- **Prepare** part programs involving various operations for the manufacturing of simple and complex products
- **Integrate** the knowledge learnt in 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 Processes 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 nanoptical, 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.

REFERENCES

1. CAD / CAM Theory and Practice by Ibrahim Zeid; Publisher: Tata McGraw Hill.
2. Automation, Production Systems and Computer integrated Manufacturing by Groover; Publisher: Pearson Education.
3. CAD / CAM / CIM by Radhakrishnan and Subramanian; Publisher: Pearson Education.
4. Principles of Computer Aided Design and Manufacturing by Farid Amirouche; Publisher: Pearson Education.
5. CAD/CAM: Concepts and Applications by Alavala; Publisher: Prentice Hall International.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year I Semester	**L**	**T/P/D**	**C**
Elective I	**3**	**0**	**3**

(5AE73) VEHICLE BODY ENGINEERING AND SAFETY

Course Prerequisites: Metallurgy and Material science, Automotive Chassis, Engineering Design and Theory of Machines

Course Objectives

- **Review** of materials for automotive structures and body panels
- **Understanding** of aesthtics and ergonomics for automobiles
- **Provide** classification of vehicle bodies, construction and safety aspects
- **Identification** of noise, vibration and harshness sources, control and measuring techniques

Course Outcomes

After completion of the course the student is able to

- **Choose** the materials for automotive structures and body panels
- **Apply** aesthetics and ergonomic considerations for automobiles
- **Categorize** vehicle bodies, construction details and safety measures
- **Use** noise, vibration and harshness control and measuring techniques

UNIT I

Structural Materials: Aluminium alloy sheet, extrusion and casting, austenitic and ferritic stainless steels, alloy steels, different types of composites, FRP and metal matrix composites. Structural timbers, properties designing in GRP and high strength composites different manufacturing techniques of composites. Thermo plastics, ABS and styrenes. Load bearing plastics, semi-rigid PUR foams and sandwich panel construction.

UNIT II

Shaping and Packaging: Product design and concepts, aesthetics and industrial design, formal aesthetics and shape. Computer aided drafting, surface development and interior ergonomics. Ergonomics system design, dashboard instruments and mechanical package layout.

Car Body: Types - Saloon, convertibles, limousine, estate van, racing and sports car. Visibility regulations, driver's visibility, improvement in visibility and tests for visibility. Driver seat design, car body construction, various panels in car bodies and safety aspects of car body.

UNIT III

Bus Body: Types of bus body based on capacity, distance travelled and based on construction, body lay-out for various types, types of metal sections used, regulations.

Constructional details - Conventional and integral, driver seat design and safety aspects of bus body.

Commercial vehicles: Types commercial vehicle bodies, light commercial vehicle body. Construction details of commercial vehicle body - Flat platform body, Trailer, Tipper body and Tanker body.

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UNIT IV

Crashworthiness: Goals and requirements, injury mechanisms - Neck, head, thoracic, abdomen, knee and ankle. Impact analysis - Front end collisions, rear end collisions and roll over protection.

Anthropomorphic Test Devices: Hybrid dummies II, hybrid dummies III, CRABI Infant dummies and side impact dummies.

UNIT V

Noise, Vibration and Harshness: Basics, sources of noise and vibration - Road surface, wheel, engine, transmission, brakes, and aerodynamics. Assessment and control of interior and exterior noise, sensitivity to noise, Basic noise and vibration measurement techniques, squeak, rattle and tizz noise.

TEXT BOOKS

1. Sydney F Page, “Body Engineering”, .
2. Powloski, J., "Vehicle Body Engineering", Business Books Ltd., 1998.
3. Matthew Harrison, “Vehicle Refinement Controlling Noise and Vibration in Road Vehicles”, SAE International, SAE ISBN 0 7680 15057.

REFERENCES

1. Heldt, P.M., “Automotive Chassis”, chilton and Co.
2. Handbook on Vehicle Body Design, SAE Publications.
3. Ulrich Seiffert and Lothar Wech, “Automotive Safety Handbook”, SAE International, SAE ISBN 978-0-7680-1798-4.
4. Lorenzo Morello., “The Automotive Body Volume II: System Design”, Springer.
5. Paul Du Bois et al, “Vehicle Crashworthiness and Occupant Protection”, American Iron and Steel Institute, 2004.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year I Semester	**L**	**T/P/D**	**C**
Elective I	**3**	**0**	**3**

(5AE74) FUEL CELL TECHNOLOGY

Course Prerequisites: Physics, Chemistry, Heat and Mass Transfer

Course Objectives

- **Study** the concepts, principle and working of fuel cell
- **Present** the components and automotive applications of fuel cell
- **Explain** the fueling techniques for fuel cell
- **Provide** the performance and analysis of fuel cell

Course Outcomes

After completion of the course the student is able to

- **Understand** the concepts, principle and working of fuel cell
- **Describe** the components and automotive applications of fuel cell
- **Assess** the fueling techniques for fuel cell
- **Analyze** the performance of fuel cell

UNIT I

Introduction to Fuel Cells: Introduction, working and types of fuel cell, low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells, thermodynamics and electrochemical kinetics of fuel cells.

UNIT II

Fuel Cells for Automotive Applications: Fuel cells for automotive applications, technology advances in fuel cell vehicle systems, onboard hydrogen storage, liquid hydrogen and compressed hydrogen, metal hydrides, fuel cell control system, alkaline fuel cell and road map to market.

UNIT III

Fuel Cell Components and their Impact on Performance: Fuel cell performance characteristics, current/voltage, voltage efficiency and power density, Ohmic resistance, kinetic performance, mass transfer effects, membrane electrode assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates.

UNIT IV

Fueling: Hydrogen storage technology – pressure cylinders, liquid hydrogen and metal hydrides, methods of hydrogen production, carbon fibers, reformer technology – steam reforming, partial oxidation, auto thermal reforming, CO removal and fuel cell technology based on removal like bio-mass.

UNIT V

Fuel Cycle Analysis: Introduction to fuel cycle analysis, application to fuel cell and other competing technologies like battery powered vehicles. SI engine fueled by natural gas and hydrogen and hybrid electric vehicle.

TEXT BOOKS

1. Viswanathan B. and Scibioh Aulice M, “Fuel Cells: Principles and Applications”, University Press, 2006.
2. Fuel Cells for automotive applications – professional engineering publishing UK. 2004.

REFERENCES

1. Frano Barbir, “PEM Fuel Cells: Theory and Practice”, Elsevier Academic Press, USA, 2005.
2. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRS Press, 2004.
3. Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press, 2003.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year I Semester	**L**	**T/P/D**	**C**
Elective I	**3**	**0**	**3**

(5ME74) AUTOMATION AND ROBOTICS

(Common to ME & AE)

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

Course Objectives

- **Analyze** the concepts of automation and robotics and components, end effectors of robots
- **Evaluate** the motion analysis, kinematics, dynamics and types of robot motions
- **Study** the different actuators and sensors used to control the robots
- **Analyze** the basics of robot programming, its languages and the industrial applications of robots

Course Outcomes

After completion of the course the student is able to

- **Evaluate** the positions, angles of the manipulators given the required motion analysis, kinematics, dynamics and trajectory planning concepts
- **Analyze** the different types of feedback components and sensors used in robots
- **Create** and analyse the program for a robot using the programming languages
- **Analyze** the applications of robots in manufacturing by studying different work cells of the robots

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year I Semester	**L**	**T/P/D**	**C**
Elective I	**3**	**0**	**3**

(5ME76) QUALITY ENGINEERING IN MANUFACTURING

(Common to ME & AE)

Course Prerequisites: Statistics, Statistical Quality Control.

Course Objectives

- **Understand** the types of factors and principles of Quality Loss Function
- **Understand** the robust design methodology in solving practical engineering problems
- Com**p**rehend the various quality control tools

Course Outcomes

Students will be able to:

- **Value** the concept of quality, use quality tools and obtain the quality loss
- **Utilize** the analytical techniques to find out the variation in the data and obtain optimal results
- **Select** and use the proper orthogonal arrays in designing, conducting and analyzing the experiments
- **Formulate** parameter and tolerance design strategies

UNIT I

Quality Value and Engineering: An overall quality system, Quality engineering in product design, Quality engineering in design of production processes, Quality engineering in production.

Loss Function and Quality Level: Derivation and use of Quality Loss Function (QLF), Economic consequences of tightening tolerances as a means to improve quality, Evaluations and types tolerances - N-type, S-type and L-type.

UNIT II

Analysis of Variance (ANOVA): NO - way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT III

Orthogonal Arrays: Introduction to OA, Degrees of Freedom, Structure of OA, Linear Graphs & Interaction tables, Strategies in Experimentation - Typical test strategies, Better test strategies & Efficient test strategies, Steps in designing, conducting and analyzing an experiment.

Interpolation of Experimental Results: Interpretation methods, Percent contribution, Estimating the mean.

UNIT IV

Tolerance Design and Tolerancing: Functional limits, Tolerance design for N-type, L-type and S-type characteristics, Tolerance allocation for multiple components.

Parameter and Tolerance Design: Introduction to parameter design, Signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

UNIT V

Quality Tools: ISO-9000 Quality System, Business Process Re-engineering (BPRE), Six-sigma, Bench making, Quality circles, Brain Storming, Fishbone diagram.

TEXT BOOKS

1. Taguchi Techniques for Quality Engineering /Phillip J. Ross/ McGraw Hill, Intl. II Edition, 1995.
2. Quality Engineering in Production systems / G. Taguchi, A- Elsayed et al / McGraw Hill Intl. Edition, 1989.

REFERENCES

1. Quality Engineering using Robust Design / Madhav S. Phadke / Pearson Education.
2. Total Quality Management / Poornima M. Charantimath / Pearson Education.
3. Taguchi Methods explained: Practical steps to Robust Resign / Tapan P. Bagchi /Prentice Hall Ind Pvt. Ltd., New Delhi.

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B.Tech. IV Year I Semester	**L**	**T/P/D**	**C**
Elective II	**3**	**0**	**3**

(5AE81) FINITE ELEMENT ANALYSIS

Course Prerequisites: Mathematics, Mechanics of Solids and Heat Transfer

Course Objectives

- **Introduce** different concepts of numerical methods
- **Summarise** the boundary conditions, formulations and other functional approaches of FEA
- **Explain** real life applications in dynamic analysis

Course Outcomes

After completion of the course the student is able to

- **Identify** various approaches applied to FEA
- **Analyse** the given problem for finding solution using finite element technique
- **Apply** the concept of FEA to solve different field problems

UNIT I

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

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.

Dynamic Analysis: 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. Tirupathi R. Chandrupatla and Ashok D. Belegundu, Introduction to Finite Elements in Engineering, 4th edition, Pearson, 2011.
2. Reddy J. N., An Introduction to Finite Element Methods, McGraw Hill Education, 3rd edition, 2005.

REFERENCES

1. Rao, S. S., Finite Element Method in Engineering, 5th edition, Butterworth-Heinemann, 2010.
2. Bathe, K.J., Finite Element Procedures, Prentice-Hall, 1996.
3. Zienkiewicz O. C., The Finite Element Method, 3rd edition, McGraw-Hill, 1977.

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B.Tech. IV Year I Semester	**L**	**T/P/D**	**C**
Elective II	**3**	**0**	**3**

(5AE75) AUTOMOTIVE INFOTRONICS

Course Prerequisites: Automotive Chassis and Automobile Electrical and Electronics

Coarse Objectives

- **Understand** the interdisciplinary concepts and intelligent automotive systems
- **Provide** an overview of the components and solutions which are available for use in GPS-enabled applications
- **Know** the adaptive cruise control systems and comfort systems
- **Identify** the safety and security systems

Course Outcomes

After completion of the course the student is able to

- **Discuss** the need of implementing intelligent vehicle technologies
- **Address** the key technologies that behind the communication systems
- **Describe** the basic concepts of control systems
- **Present** the constructional features of various growing technologies like adaptive cruise control systems, safety systems, security systems and comfort systems

UNIT I

Introduction: Driver information, driver perception, driver convenience, driver monitoring, general vehicle control, longitudinal and lateral control, collision avoidance, vehicle monitoring.

UNIT II

Telematics: Global positioning system, geographical information systems, navigation system, architecture, automotive vision system, road recognition.

UNIT III

Safety Systems: Active and passive safety, airbags, seat belt tightening system, forward collision warning systems, child lock, anti lock braking systems, traction control system, lane departure warning system.

UNIT IV

Comfort Systems: Adaptive cruise control system, active suspension system, power steering, collapsible and tiltable steering column, power windows.

UNIT V

Security Systems: Anti theft technologies – mechanical, electromechanical and electronic immobilizers, alarm system, stolen vehicle tracking system, remote keyless entry, smart card system, number plate coding.

TEXT BOOKS

1. Ljubo Vlacic, Michel Parent and Fumio Harashima, “Intelligent Vehicle Technologies: Theory and Applications”, Butterworth-Heinemann publications, Oxford, 2001.
2. Ronald K Jurgen, “Navigation and Intelligent Transportation Systems – Progress in Technology”, Automotive Electronics Series, SAE, USA, 1998.

REFERENCES

1. William B Riddens, “Understanding Automotive Electronics”, 5th edition, Butter worth Heinemann Woburn,1998.
2. Bechhold, “Understanding Automotive Electronics”, SAE, 1998.
3. Robert Bosch, “Automotive Hand Book”, 5th Edition, SAE, 2000.

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B.Tech. IV Year I Semester	**L**	**T/P/D**	**C**
Elective II	**3**	**0**	**3**

(5ME77) COMPUTATIONAL FLUID DYNAMICS

(Common to ME & AE)

Course Prerequisite: C Programming skills, Numerical Methods, Fluid Mechanics.

Course Objectives

- **Familiar** with the differential equations for flow phenomena and numerical methods for their solution
- **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

After completion of the course the student is able to

- **Solve** fluid flow and heat transfer problems using numerical methods and Programming
- **critically analyze** different mathematical models and computational methods for flow simulations
- **Write** algorithms to solve the complex non linear equations numerically and able to do a project demonstrating your understanding
- **Conduct** the stability analysis and check the applicability of different schemes

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year II Semester	**L**	**T/P/D**	**C**
Elective II	**3**	**0**	**3**

(5ME80) PRODUCT LIFE CYCLE MANAGEMENT

(Common to ME & AE)

Course Prerequisite: Mathematics, computers and use of software's packages

Course Objectives

- **Understand** PLM Strategies
- **Know** the principles of product life cycle
- **Understand** business process
- **Understand** importance of forecasting

Course Outcomes

After completion of the course the student is able to

- **Forecast** the demand of the product
- **Develop** a new product strategy
- **Predict** the life cycle of product
- **Interpret** the life cycle process of individual items

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.

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.
3. Martins Joseph, Technological Forecasting for decision Making, 2nd edition, North Holland.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year I Semester

L	T/P/D	C
0	3	2

(5AE53) VEHICLE MAINTENANCE AND TESTING LABORATORY

Course Prerequisites: Automotive Engines and Systems, Automotive Chassis and Automotive Electrical and Electronics

Course Objectives

- Hands on **training** in in automotive shops with safety procedures
- Vehicle **inspection** and identification of faults
- **Diagnosis** using suitable test equipments and use of service manuals
- **Adjust** / repair / replacement of parts

Course Outcomes

After completion of the course the student is able to

- **Identify** different systems of a vehicle and their functionality
- **Inspect** the vehicle and identify the faults
- **Perform** fault diagnosis and detection using suitable test equipment
- **Execute** maintenance and repair/replacement operations

LIST OF EXPERIMENTS

1. Vehicle inspection
2. Engine compression test
3. Engine manifold vacuum test
4. Automotive battery test
5. Multi car scanning
6. Petrol vehicle exhaust analysis
7. Diesel smoke measurement
8. Wheel balancing of wheel and tyre assembly
9. Wheel alignment test
10. Headlight alignment test
11. Ignition timing test

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year I Semester **L T/P/D C**
0 3 2

(5ME62) CAD/CAM LABORATORY

(Common to ME & AE)

Course Prerequisites: CAD, CAM and SOM

Course Objectives

- **Understand** the ways in which 2D sketches and 3D models – solid and surface are made using appropriate CAD packages
- **Know** the procedure of building assembly drawings and obtain drafted views from it
- **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

After completion of the course the student is able to

- **Summarize** the skills learnt in sketching and modeling using CAD packages
- **Design** product assemblies and obtain drafted views from it
- **Produce** components with different features using CNC machines and machining centers
- **Analyze** the stress and strain in various structures

12 exercises from the following syllabus

CAD

1. 2D Drawing using Sketcher workbench – 1 exercise containing at least 3 drawings
2. 3D modeling using 3D features – 1 exercise containing at least 3 models
3. Assembly and drafting – 1 exercise containing 1 assembly
4. Surface Modeling – 1 exercise
5. Sheet Metal Working – 1 exercise

Softwares: AutoCAD, IronCAD, CATIA, CREO

CAM

1. Part programming for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning operations
2. Part programming for Point to point motions, Linear motions, Circular interpolation, Contour motion, Pocket milling - Circular, Rectangular and Mirror commands
3. Part Programming using Fixed or Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning, Thread cutting

4. Generation of tool path, NC part program and its simulation
5. Machining of small components using CNC Lathe, CNC Mill and CNC Turning center

Softwares: CNC Offline Simulation, EdgeCAM

CAE

1. Determination of deflection and stresses in 2D and 3D trusses and beams
2. Determination Principal/ Von-mises stresses and deflections, in plane stress/ plane strain/ axisymmetric models
3. Determination of stresses in 3D and shell structures

Software: ANSYS

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year I Semester

L	T/P/D	C
0	3	2

(5AE54) VEHICLE DYNAMICS AND AUTOTRONICS LABORATORY

Course Prerequisites: Theory of Machines, Vehicle Dynamics and Automotive Electrical and Electronics

Course Objectives

- **Understand** the whirling of shaft and the effect of natural frequency of undamped and damped free vibration system
- **Understand** the static and dynamic balancing and the gyroscopic effects
- **Concepts** and develop basic skills necessary to diagnose automotive electrical systems
- **Testing** of automotive batteries, starting, and charging systems

Course Outcomes

After completion of the course the student is able to

- **Calculate** the natural frequency of Undamped and damped free vibration system
- **Balance** the static and dynamic forces and the gyroscopic effects
- **Troubleshoot** different electrical faults in a vehicle
- **Test** automotive batteries, starting, and charging systems

LIST OF EXPERIMENTS (Any ten experiments)

VEHICLE DYNAMICS

1. To determine whirling speed of shaft theoretically and experimentally.
2. To determine the natural frequency of undamped torsional vibration of a single rotor shaft system.
3. To determine the natural frequency of undamped torsional vibration of two rotor shaft system.
4. To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis.
5. To determine the frequency of undamped free vibration of an equivalent spring mass system.
6. To determine the frequency of damped force vibration of a spring mass system.
7. To study the static and dynamic balancing using rigid blocks.
8. To determine gyroscopic couple on motorized gyroscope.
9. To study gyroscopic effects through models.

AUTOTRONICS

1. Testing of batteries and battery maintenance
2. Testing of starting motors and generators
3. Testing of alternators
4. Testing of regulators and cut – outs
5. Diagnosis of ignition system faults
6. Study of Automobile electrical wiring
7. Interfacing Sensors like RTD, LVDT, and Load Cell etc.
8. Interfacing ADC for Data Acquisition
9. Interfacing DAC for Control Application
10. Interfacing A/D converter and simple data acquisition

R15

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year II Semester

L	T/P/D	C
3	0	3

(5AE12) REFRIGERATION AND AUTO AIR CONDITIONING

Course Prerequisites: Thermodynamics and Applied Thermodynamics

Course Objectives

- **Understand** various refrigeration cycles and working of conventional and unconventional refrigeration systems
- **Estimate** vehicle cooling load
- **Explain** heating ventilation and air conditioning systems and components
- **Diagnose** and Troubleshooting of air conditioners and heating systems

Course Outcomes

After completion of the course the student is able to

- **Apply** refrigeration cycles in conventional and unconventional refrigeration systems
- **Evaluate** vehicle cooling loads and capacity of refrigeration and air conditioning systems
- **Describe** heating ventilation and air conditioning systems and components
- **Examine** and servicing of air conditioners and heating systems

UNIT I

Vapour Compression Refrigeration: Working principle, refrigeration cycle in T-s and P-h coordinates, effect of sub cooling and super heating and cycle analysis.

Air Refrigeration: Applications, air craft refrigeration - simple, bootstrap, regenerative systems, vehicle cooling, load estimation, capacity requirements of air conditioning system, refrigerants used in automobiles and properties.

UNIT II

Vapor Absorption System: Aqua-Ammonia system and Lithium-Bromide system.

Steam Jet Refrigeration System: Representation on T-s and h-s diagrams, limitations and applications.

Unconventional Refrigeration System: Thermo-electric, vortex tube and pulse tube – working principles.

UNIT III

Introduction to Air Conditioning: Psychrometric properties and processes, sensible and latent heat loads, characterization and SHF load for ventilation and filtration, concepts of RSHF and SHF ESHF and ADP, concepts of human comfort and effective temperature.

Components of Air Conditioners: Air-conditioning components: Compressor, evaporator, condenser, expansion valve, receiver, drier, filters, mufflers, special features and compressor protection anti freezing relay.

UNIT IV

Operation of an Air-Conditioning System: Type of air conditioners, heaters, vehicle ventilation, combination heater and air conditioner, manually controlled air conditioner and heater system, automatically controlled air conditioner and heater systems.

Air Heating Equipment: Ducts, registers and grills, blowers and filters.

UNIT V

Trouble Shooting and Services: Servicing of heating systems, causes of air conditioner failure, leak testing guide, discharging the system, evacuating the system, charging the system and troubleshooting air conditioner heater Systems

Servicing of Air Conditioners- Heating Systems: Air conditioner maintenance and service, compressor trouble shooting and service, clutch service, shaft seal leakage compressor, seal removal checking oil level, oil addition and repairs on compressors.

TEXT BOOKS

1. Refrigeration & Air Conditioning – C.P. Aurora-TMH.
2. Automotive Air Conditioning –William .H.Crouse & Donald L.Angtin.-MH.

REFERENCES

1. Refrigeration & Air Conditioning – Aurora & Domkundwar – Dhanpat Rai
2. Refrigeration and Air Conditioning: Manohar Prasad.
3. Refrigeration and Air Conditioning: Stoecker – Mc Graw Hill.
4. Refrigeration and Air Conditioning: Dossat – Mc Graw Hill.
5. Refrigeration and Air Conditioning: Domkundwar – Dhanpatrai.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year II Semester	**L**	**T/P/D**	**C**
Elective III	**3**	**0**	**3**

(5AE76) ALTERNATIVE FUELS AND TECHNOLOGIES

Course Prerequisites: Engineering chemistry, Automotive Engines and Systems

Course Objectives

- **Identify** various sources of alternative fuels for SI and CI engines
- **Know** the benefits and engine modifications required for using alternative fuels
- **Provide** the quality standards, regulations and third-party inspection for alternative fuel vehicles
- **Describe** the electric, hybrid, fuel cell and solar vehicle technologies

Course Outcomes

After completion of the course the student is able to

- **Select** alternative fuels for using on SI and CI engines
- **Explain** the benefits and engine modifications required for using alternative fuels
- **Recognise** quality standards, regulations and third-party inspection for alternative fuel vehicles
- **Discuss** the electric, hybrid, fuel cell and solar vehicle technologies

UNIT I

Gaseous Fuels: Properties, composition, production, storage, engine modifications, combustion, performance and emission characteristics in SI and CI engines, advantages and disadvantages of CNG, LPG, hydrogen and ammonia.

UNIT II

Alcohol Fuels: Properties, composition, production, storage, engine modifications, blends, combustion, performance and emission characteristics in SI and CI engines, advantages and disadvantages of methanol ethanol and butanol.

UNIT III

Bio-Fuels: Properties, composition, production, engine modifications, treatment, blends, performance and emission characteristics, advantages and disadvantages of straight vegetable oils, bio-diesel and biogas.

UNIT IV

Electric and Hybrid Vehicles: Electric vehicles - Layout of an electric vehicle, components, performance of electric vehicles, advantage and limitations. Hybrid vehicles - Concepts of hybrid electric drive train, types, architecture of series and parallel and series-parallel hybrid electric drive train, merits and demerits.

UNIT V

Fuel Cell and Solar Vehicles: Fuel cell vehicle – Operating principle, types of fuel cells, fuel cell options for fuel cell vehicle and fuel cell hybrid vehicle. Solar vehicle - Solar photovoltaic cell, solar array, solar car electrical system and drive train.

TEXT BOOKS

1. Thipse S. S., “Alternative fuels”, Jaico Publishers, 2010.
2. Mehrdad Ehsani, Yimin Gao, sebastien E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2005.

REFERENCES

1. Ramireddy and Yousuf, “A text book of alternative fuel of Automobile Engine”, Front line Publishers.
2. Forest Gregg, “Powering Your Vehicle With Straight Vegetable Oil”.
3. Iqbal Husain, “Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
4. Ronald K Jurgen, “Electric and Hybrid – Electric Vehicles”, SAE, 2002.

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B.Tech. IV Year II Semester	**L**	**T/P/D**	**C**
Elective III	**3**	**0**	**3**

(5AE77) FLUID POWER SYSTEMS

Course Prerequisites: Fluid Mechanics, Thermodynamics, Engineering Mechanics, Mathematics

Course Objectives

- **Understand** about the hydraulic control system components
- **Understand** about the pneumatic control system components
- **Understand** about the design of fluid power circuits

Course Outcomes

After completion of the course the student is able to

- **Apply** fundamental knowledge of hydraulic systems in automation
- **Apply** fundamental knowledge of pneumatic systems in automation
- **Apply** fundamental knowledge to fluid power circuits designing in automation

UNIT I

Hydraulic Power Systems: Introduction, Classification of Power Systems - Mechanical Power Systems, Electrical Power Systems, Pneumatic Power Systems, Hydrodynamic Power Systems, Hydrostatic Power Systems, Basic Hydraulic Power Systems, The Advantages and Disadvantages of Hydraulic Systems, Comparing Power Systems.

Basic Properties of Hydraulic Oils, Classification of Hydraulic Fluids, Typically Used Hydraulic Fluids, Mineral Oils, Fire-Resistant Fluids, Additives, Requirements Imposed on the Hydraulic Liquid

UNIT II

Hydraulic Pumps: Introduction, Classification of Pumps – Bent Axis Axial Piston Pumps, Swash Plate Pumps with Axial Pistons, Swash Plate Pumps with Inclined Pistons, Axial Piston Pumps with Rotating Swash Plate-Wobble Plate, Radial Piston Pumps with Eccentric Cam Ring, Radial Piston Pumps with Eccentric Shafts, Radial Piston Pumps of Crank Type, External Gear Pumps, Internal Gear Pumps, Gerotor Pumps, Screw Pumps, Vane Pumps, Variable Displacement Pumps, Rotodynamic Pumps

UNIT III

Hydraulic Control Valves: Introduction, Pressure-Control Valves, Direct-Operated Relief Valves, Pilot-Operated Relief Valves, Pressure-Reducing Valves, Sequence Valves,

Accumulator Charging Valve, Directional Control Valves – types, Check Valves – types, Flow Control Valves – types.

Accessories: Hydraulic Accumulators - Classification, Construction, Operation and Applications of Hydraulic Accumulators, Hydraulic Filters, Hydraulic Pressure Switches – types.

UNIT IV

Hydraulic Actuators: Hydraulic Cylinders – Construction, Classification, Hydraulic Rotary Actuators – types, Hydraulic Motors – types, Hydraulic Circuits.

Hydraulic Servo Actuators: Construction, Operation and Applications of Hydraulic Servo Actuators, Valve-Controlled Actuators.

UNIT V

Pneumatic Systems: Introduction, Peculiarities of Pneumatic Systems, Advantages and Disadvantages of Pneumatic Systems, Basic Elements of Pneumatic Systems, Basic Pneumatic Circuits, Air Compressors, Pneumatic Reservoirs, Air Filters, Air Lubricators, Pneumatic Control Valves, Manual Control of a Single- Acting Cylinder, Unidirectional Speed Control of a Single-Acting Cylinder, Bidirectional Speed Control of a Single-Acting Cylinder, Bidirectional Speed Control of a Double-Acting Cylinder, Unidirectional and Quick Return Control of a Double-Acting Cylinder.

TEXT BOOK

1. Fluid Power Engineering - M. Galal Rabie - McGraw-Hill publications.

REFERENCES

1. Design of Hydraulic Control Systems - Ernest e. Lewis, Hansjoerg stern - McGraw-hill Publications.
2. Fluid Power Control - John f. Blackburn, Gerhard Reethof, J. Lowen shearer - John Wiley and sons inc.

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B.Tech. IV Year II Semester	**L**	**T/P/D**	**C**
Elective III	**3**	**0**	**3**

(5ME82) DESIGN FOR MANUFACTURING

(Common to ME & AE)

Course Prerequisites: Production Technology, Metallurgy & Material Science, Design Concepts, Automation, Machine Tools

Course Objectives

- **Understand** the methodology of AFMA, in terms of design process, Material selection and its relationship with the Manufacturing Processes
- **Understand** the manufacturing processes like machining, casting, metal joining, cold working operations like forging, extrusion of metals
- **Understand** various sheet metal operations and the design concepts behind them
- **Understand** various design processes to be used manual, automatic assembly and material handling equipment

Course Outcomes

After completion of the course the student is able to

- **Apply** the rules and methods for the design of machine component and products
- **Apply** appropriate methods for selecting the materials and the processes involved in manufacture of various components and systems
- **Process** metals by cold working, sheet metal and joining operations by applying relevant rules
- **Design** and develop manual and automatic assembly processes using various tools

UNIT I

Introduction: Design philosophy, Steps in design process, General design rules for manufacturability, Basic principles of designing for economical production, Creativity in design.

Materials: Selection of materials for design, 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.

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B.Tech. IV Year II Semester	**L**	**T/P/D**	**C**
Elective III	**3**	**0**	**3**

(5ME84) PRINCIPLES OF ENTREPRENEURSHIP

(Common to ME & AE)

Course Prerequisites: General Management & Financial Accounting concepts, Enthusiasm towards Entrepreneurship

Course Objectives

- **Analyze** the entrepreneurial process involved in creating, managing a new enterprise
- **Analyze** the background and apply tools necessary to participate in the entrepreneurial process
- **Evaluate** the fundamental business framework
- **Enables** students to master the need to effectively apply the theories and various approaches of entrepreneurship to create wealth

Course Outcomes

After completion of the course the student is 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 create opportunities to solve entrepreneurial issues while starting an enterprise
- **Master** the relevance of Entrepreneurship and Entrepreneurs to the economic development of the nation especially regarding job creation and poverty alleviation in general

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: Entrepreneurs- Talent, Temperament, Technique, Butterworth Heinemann, 2001.

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B.Tech. IV Year II Semester	**L**	**T/P/D**	**C**
Elective IV	**3**	**0**	**3**

(5AE78) AUTOMOTIVE POLLUTION AND CONTROL

Course Prerequisites: Automotive Engines and Systems

Course Objectives

- **Understand** the sources of automotive emissions and their ill effects on environment and human beings
- **Discuss** the formation of pollutants from SI and CI and the operating parameters influences emission
- **Provide** different techniques used to control emission from SI and CI engine vehicles
- **Learn** various emission measurement techniques, standards and test procedures

Course Outcomes

After completion of the course the student is able to

- **Analyze** the sources of automotive emissions and their ill effects on environment and human beings
- **Explain** the formation of pollutants from SI and CI and the operating parameters influences emission
- **Apply** techniques used to control emission from SI and CI engine vehicles
- **Identify** various pollution measurement techniques, standards and control of emissions

UNIT I

Introduction: Types of emission and transient operational effects on pollution, sources of emission, effect of pollution on human health, role of fuels in engine emission, effect of fuel properties and additives on emissions, vehicle population and contribution to pollution, and emission norms.

UNIT II

Pollutant Formation in SI Engines: Pollutant formation in SI engines, mechanism of HC and CO formation in four stroke and two stroke SI engines, NO_x formation in SI engines, effects of design and operating variables on emission formation,

UNIT III

Pollutant Formation in CI Engines: Pollutant formation in CI engines, smoke and particulate emissions in CI engines, effects of design and operating variables on CI engine emissions, No_x formation and control.

UNIT IV

Control of Emissions From SI and CI Engines: Design of engine, optimum selection of operating variables for control of emissions, types of catalytic converters, catalytic mechanism, crankcase emission control, fuel evaporation control, exhaust gas recirculation, SCR, thermal reactors and secondary air injection.

UNIT V

Measurement Techniques and Test Procedure: Orsat Apparatus, NDIR (Non Dispersive Infra Red) ananyser, FID (Flame Ionization Detector) detector, Chemiluminescent analyzer, Gas Chromatograph, smoke meters, driving cycles – USA, Japan, Euro and India. Test procedures – ECE (Economic Commission for Europe), FTP (Federal Test Procedure), SHED (Sealed Housing for Evaporative Determinations) Test – chassis dynamometers and dilution tunnels.

TEXT BOOKS

1. John B Heywood, “Internal Combustion Engine Fundamentals”, McGraw Hill International Editions, 1988.
2. Paul Degobert, “Automobiles and Pollution”, SAE International, ISBN-1-56091-563-3.

REFERENCES

1. Ganesan V, “Internal Combustion Engines”, 4th edition, Tata McGraw Hill, New Delhi, 2012.
2. Obert E F, “Internal Combustion Engine analysis and Practice ", International Text Book Co., Scranton, Pennsylvania, 1988.
3. SAE Transactions- “Vehicle Emission”- 1982 (3 volumes).
3. Marco Nute- “Emissions from two stroke engines, SAE Publication.
4. Heinz Heisler, “Advanced Engine Technology”, SAE 1995.

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B.Tech. IV Year II Semester	**L**	**T/P/D**	**C**
Elective IV	**3**	**0**	**3**

(5AE79) PLANT LAYOUT AND MATERIAL HANDLING SYSTEMS

Course Prerequisite: Knowledge of manufacturing, Operations Research

Course Objectives

- **Apply** plant layout system, its types and software tools used
- **Analyze** elements of various material handling systems
- **Create** an appropriate material handling system
- **Create** an efficient storage system

Course Outcomes

After completion of the course the student is able to

- **Evaluate** an appropriate plant layout for a plant
- **Create** flexible plant layout to accommodate changes in product volume or product type
- **Analyze** an appropriate material handling system
- **Evaluate** the systems and equipments used for material storage

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.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year II Semester	**L**	**T/P/D**	**C**
Elective IV	**3**	**0**	**3**

(5AE80) 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
- **Understands** the different methods of manufacturing composite materials

Course Outcomes

After completion of the course the student is able to

- **Apply** fundamental knowledge of mathematics to modeling and analysis of composite materials
- **Analyze** the the manufacturing methods of various composite materials
- **Analyze** the failure of composites
- **Synthesize** and use right composite materials for the right component

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.

NR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Year II Semester	**L**	**T/P/D**	**C**
Elective IV	**3**	**0**	**3**

(5ME88) NANO SCIENCE AND TECHNOLOGY

(Common to ME & AE)

Course Prerequisites: Maths, Physics and chemistry

Course Objectives

- **Understand** the nanomaterials and their properties
- **Gain** knowledge of different nanostructures of carbon and their properties
- **Know** applications of carbon nanotubes
- **Build** technologies to design, realize and analyze micro and nano-scale electronic devices, materials and systems, coupled with general and technology management

Course Outcomes

After completion of the course the student is able to

- **Create** solutions in engineering, biotechnology and manufacturing by identifying current nanotechnology
- **Apply** the fundamental knowledge of science to characterize the nanomaterials
- **Synthesize** carbon Nanotubes and nano materials
- **Evaluate** tools in nanoscience for applications in various sectors

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

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.

REFERENCES

1. Nanotechnology applications to telecommunications and networking By Daniel Minoli, Wiley Interscience.
2. Nanotechnology Principles and Applications by Sulabha Kulkarni.