ACADEMIC REGULATIONS

COURSE STRUCTURE

AND

DETAILED SYLLABUS

Automobile Engineering

B.TECH. FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2011-2012)

VNR VIGNANA JYOTHI
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(AFFILIATED TO JNTUH)
An Autonomous Institute under JNTUH
Bachupally, Nizampet (S.O),
Hyderabad – 500090
Andhra Pradesh, India

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

HYDERABAD

An Autonomous Institute under JNTUH

ACADEMIC REGULATIONS 2011 FOR B.TECH. DEGREE COURSE

(Applicable for Students admitted from the academic year 2011-2012)

1. Courses of study

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

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

1.1 Eligibility Criteria for Admission

The eligibility criteria for admission into engineering programmes shall be as mentioned below:

The candidate shall be an Indian National.

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.

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

1.1.1 Category – A Seats

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

1.1.2 Category - B Seats

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

1.1.3 Category: Lateral Entry

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

2. Distribution and Weightage of Marks

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

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

For theory subjects, Two mid examinations will be conducted in each Semester as per the academic calendar. Each mid examination is evaluated for 25 marks. First mid examination should be conducted for 1 – 2 ½ Units of syllabus and the second mid examination shall be conducted for 2 ½ - 5 Units of syllabus. The mid descriptive type exam paper consists of Section-A and Section-B.

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

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

Two assignments are to be given to students covering the syllabus of first Mid and second Mid examinations and are evaluated for 5 marks each. .

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

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

(a) 25 marks for the better of the two mid term examinations
(b) 5 marks is the average of the two assignment marks

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

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

iv For the subjects having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing, Production Drawing Practice, and Estimation etc., the distribution shall be 30 **marks for internal evaluation (15 marks for day-to-day work and 15 marks for internal tests (**the better of the two examinations will be taken into account**) and 70 marks for end examination.** There shall be **two internal tests** in a Semester.

iv. There shall be an **industry-oriented mini-Project**, in collaboration with an industry of their specialization, to be taken up during the vacation after III year II Semester examination. The **mini project shall be evaluated during the IV year I Semester.** The industry oriented mini project shall be submitted in report form and should be presented before a committee, which shall be evaluated for **50 marks.** The committee consists of Head of the Department, the supervisor of mini project and a senior faculty member of the department. There shall be **no internal assessment for industry oriented mini project.**

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 report shall be evaluated for **50 marks**. There shall be **no external examination for Seminar.**

vii. There shall be a **Comprehensive Viva-Voce in IV year II Semester**. The Comprehensive Viva-Voce will be conducted by a Committee consisting of the Head of the Department and three Senior Faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the student's understanding in various subjects studied during the B.Tech. course of study. The Comprehensive Viva-Voce is evaluated **for 50 marks** by the Committee. There will be **no internal assessment for the Comprehensive viva-voce.**

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

3. Semester end Examination

(a) Theory Courses

Each course is evaluated for 70 marks. Examination is of 3 hours duration.
Question paper contains two sections [Section-A and Section-B]

Section-A: Carries 30 marks [Five questions of one mark each, five questions of two marks each and another five questions of three marks each] which is compulsory.

Section-B: carries 40 marks consisting of six essay type questions out of which four questions are to be answered, each carrying 10 marks.

Drawing related subjects, question paper contains 8 questions (atleast one question from each unit), out of which the candidate has to answer any 5 questions, each carrying 14 marks.

(b) Practical Courses

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

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

(c) Supplementary Examinations

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

4. Attendance Requirements

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

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

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

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

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

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

5. Minimum Academic Requirements

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

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

ii. A student shall be **promoted from II to III year** only if he fulfils the academic requirement of **37 credits from Two regular and one supplementary**

examinations of I year I Semester and One Regular and One Supplementary exam of I year II Semester, and one regular examination of II year I Semester irrespective of whether the candidate takes the examination or not.

iii. A student shall be **promoted from III year to IV year** only if he fulfils the academic requirements of total **62 credits from the following examinations,** whether the candidate takes the examinations or not.

- Three regular and Two supplementary examinations of I B Tech I Semester.
- Two regular and two Supplementary examinations for I B Tech II Semester
- Two regular and one supplementary examinations up to the end of II year I Semester.
- One regular and one supplementary examinations of II year II Semester.
- One regular examination of III year I Semester.

iv. A student shall register and put up minimum academic requirement in all 200 credits and earn the 200 credits. Marks obtained in all 200 credits shall be considered for the calculation of percentage of marks.

v. Students who fail to earn 200 credits as indicated in the course structure **within eight academic years** from the year of their admission shall **forfeit their seat** in B.Tech. course and their **admission shall get stands cancelled.**

6. Course pattern

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

ii. A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may reappear for that subject at the supplementary examination whenever conducted.

iii. When a student is detained due to shortage of attendance in any Semester, he may be re-admitted into that Semester when it is offered next, **with the academic regulations of the batch into which he gets readmitted.**

iv. When a student is detained due to lack of credits in any year, he may be eligible to be promoted or for promotion into the next year after fulfillment of the academic requirements, **with the academic regulations of the batch into which he gets admitted**

7. Award of B.Tech. Degree and Class

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

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

ii. Registered for **200 credits** and secured **200 credits.**

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

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

Class Awarded	% of marks to be secured	
First Class with Distinction	70% and above	From the aggregate marks secured for the 200 Credits.
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	
Fail	Below 40%	

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum).

8. Withholding of Results

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

9. Transitory Regulations

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

10. Minimum Instruction Days

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

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

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

13. General

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

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

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

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

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

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

(Applicable for students admitted from the academic year 2012-2013)

(i) A student shall register for all 150 credits and earn all the 150 credits. Marks obtained in all 150 credits shall be considered for the calculation of the class.

(ii) A student who fails to earn 150 credits as indicated in the course structure within **six** academic years from the year of their admission shall forfeit their seat in B.Tech. programme and their admission stands cancelled.

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

(iv) A student shall be promoted from third year to fourth year only on fulfilling the academic requirements of securing 37 credits from the following examinations.

a. Two regular and one supplementary examination of II year I Semester

b. One regular and one supplementary examination of II year II Semester

c. One regular examination of III year I Semester.

Irrespective of whether the candidate appears the Semester-End examination or not as per the normal course of study and in case of getting detained for want of credits the student may make up the credits through supplementary exams of the above exams before the date of commencement of class work for IV year I Semester.

(v) Award of B.Tech. Degree and Class

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

Class Awarded	% of marks to be secured	
First Class with Distinction	70% and above	From the aggregate marks secured for the 150 Credits. (i.e., II year to IV year)
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	
Fail	Below 40%	

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

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

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 Student 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**

Subject Code	Subject Name	Lectures	T/P/D	Credits
R11MTH1101	Mathematics I	3	1	3
R11PHY1101	Engineering Physics I	3	0	3
R11CHE1102	Chemistry of Engineering Materials	3	0	3
R11CSE1101	Computer Programming	3	0	3
R11MED1101	Engineering Mechanics I	4	1	4
R11EEE1130	Elements of Engineering	3	0	3
R11MED1102	Engineering Graphics I	2	3	2
R11EPC1201	Engg. Physics and Chemistry Lab	0	3	2
R11CSE1201	Computer Programming Lab	0	3	2
Total		**21**	**11**	**25**

I YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
R11MTH1102	Mathematics II	3	1	3
R11PHY1102	Engineering Physics II	3	0	3
R11CHE1101	Engineering Chemistry	3	0	3
R11HAS1101	English	3	0	3
R11CSE1102	Data Structures	3	0	3
R11MED1103	Engineering Mechanics II	4	1	4
R11MED1104	Engineering Graphics II	2	3	2
R11MED1201	Engineering Workshop	0	3	2
R11HAS1203	English Language and Communication Skills Lab	0	3	2
Total		**21**	**11**	**25**

VNR Vignana Jyothi Institute of Engineering and Technology

B. TECH AUTOMOBILE ENGINEERING

II YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
R11MTH1103	Mathematics III	3	1	3
R11MED1106	Mechanics of Solids I	4	1	4
R11MED1107	Thermodynamics	4	1	4
R11MED1108	Metallurgy and Material Science	3	0	3
R11MED1112	Fluid Mechanics and Turbomachinery	3	1	3
R11MED1109	Machine Drawing	0	6	4
R11MED1203	Metallurgy and Mechanics of Solids Lab	0	3	2
R11MED1205	Fluid Mechanics and Turbomachinery Lab	0	3	2
Total		**17**	**16**	**25**

II YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	Lectures	T/P/D	Credits
R11MED1110	Mechanics of Solids II	4	1	4
R11MED1111	Kinematics of Machinery	4	1	4
R11AME1101	Automotive Engines	3	1	3
R11MED1113	Applied Thermodynamics	4	1	4
R11MED1114	Production Technology	3	0	3
R11EIE1130	Fundamentals of Electrical and Electronics Engineering	3	0	3
R11AME1201	Automotive Engines Lab I	0	3	2
R11MED1210	Production Technology Lab.	0	3	2
Total		**21**	**10**	**25**

VNR Vignana Jyothi Institute of Engineering and Technology
B. TECH AUTOMOBILE ENGINEERING

III YEAR I SEMESTER COURSE STRUCTURE

Subject Code	Subject Name	Lectures	T/P/D	Credits
R11MED1115	Dynamics of Machinery	4	1	4
R11MED1116	Mechanical Engineering Design I	4	1	4
R11MTH1104	Numerical Analysis and Linear Programming	3	1	3
R11MED1117	Machine Tools	3	0	3
R11MED1118	Metrology and Instrumentation	3	0	3
R11CED1109	Environmental studies	3	0	3
R11MED1211	Machine Tools Lab	0	3	2
R11MED1212	Metrology and Instrumentation Lab	0	5	3
Total		**20**	**11**	**25**

III YEAR II SEMESTER COURSE STRUCTURE

Subject Code	Subject Name	Lectures	T/P/D	Credits
R11MED1120	Mechanical Engineering Design II	4	1	4
R11AME1102	Structural Analysis	4	1	4
R11AME1103	Automotive Chassis and Suspension	3	1	3
R11MED1122	Heat and Mass Transfer	3	1	3
R11HAS1102	Business Economics and Financial Analysis	4	0	4
R11MED1157	CAD/ CAM	3	0	3
R11AME1202	Automotive Engines Lab II	0	3	2
R11MED1213	Heat and Mass Transfer Lab and Advanced English Language Communication Skills Laboratory	0	3	2
Total		**19**	**10**	**25**

VNR Vignana Jyothi Institute of Engineering and Technology

B. TECH AUTOMOBILE ENGINEERING

IV YEAR I SEMESTER COURSE STRUCTURE

Subject Code	Subject Name	Lectures	T/P/D	Credits
R11HAS1103	Management Science	4	0	4
R11AME1104	**Elective I** Alternative Fuels for Automobiles	4	0	4
R11AME1105	Vehicle Dynamics			
R11MED1124	Automation in Manufacturing			
R11MED1126	Advanced Mechanism Design			
R11MED1128	**Elective II** Theory of Elasticity and Plasticity	4	0	4
R11MED1129	Robotics			
R11EEE1134	Automotive Electrical and Autotronics			
R11MED1132	Advanced Machine Design			
R11AME1106	**Elective III** Vehicle Transport Management	4	0	4
R11MED1133	Mechatronics			
R11MED1134	Advanced Mechanics of Solids			
R11MED1136	Tribology			
R11MED1139	**Elective IV** Unconventional Machining Processes	3	0	3
R11AME1107	Vehicle Body Engineering and Safety			
R11MED1140	Plant layout and Material Handling			
R11MED1141	Computational Fluid Dynamics			
R11AME1203	Automobile Engineering Lab	0	3	2
R11MED1208	CAD/ CAM Lab.	0	3	2
R11AME1301	Industry Oriented Mini Project	0	8	2
Total		**19**	**14**	**25**

* 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

Subject Code	Subject Name	Lectures	T/P/D	Credits
R11MED1121	Finite Element Method	3	1	3
R11AME1108	**Elective V** Auto Air Conditioning	3	0	3
R11MED1147	Production Planning and Control			
R11MED1149	Operations Research			
R11MED1158	Maintenance and Safety Engineering			
R11AME1109	**Elective VI** Automotive Pollution and Control	3	0	3
R11MED1153	Principles of Entrepreneurship			
R11MED1155	Statistical Quality Control and TQM			
R11MED1156	Fracture Mechanics			
R11AME1302	Seminar	0	3	2
R11AME1303	Comprehensive Viva	0	0	2
R11AME1304	Major Project	6	12	12
Total		**15**	**15**	**25**

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

I Year B.Tech ME/ AE I sem	L	T/P/D	C
	3	1	3

(R11MTH1101) MATHEMATICS I
(Advanced Calculus)

UNIT I

Elementary analysis

Sequences and series - convergence and divergence, ratio test, comparison test, integral test, Cauchy's root test, Raabe's test (statements only for the tests), and absolute and conditional convergence.

Mean value theorems (statements only) - Rolle's theorem, Lagrange's theorem, Cauchy's theorem, and generalized mean value theorem (Taylor's Theorem).

UNIT II

Functions of several variables

Partial differentiation; Functional dependence; Jacobian; Maxima and Minima of functions of two variables with constraints and without constraints.

Radius of curvature; Centre and circle of curvature – evolutes and envelopes.

UNIT III

Improper integrals and special functions

Improper Integrals; Beta, Gamma, and Error functions - Properties and simple applications.

UNIT IV

Curve tracing, applications of integration and multiple integrals

Curve tracing – Cartesian, polar, and parametric curves; Applications of integration to lengths, volumes and surface areas in cartesian and polar coordinates.

Multiple integrals - double and triple integrals, change of variables, and change of order of integration.

UNIT V

Vector calculus

Introduction to vector and scalar functions; Gradient, curl, divergence, and their related properties of sums and products; Laplacian and second order operators; Vector integration - line integral, work done, potential function; Area, surface, and volume integrals; Statements of Vector integral theorems and their verification (without proofs) - Green's theorem, Stoke's theorem, and Gauss divergence theorem.

TEXT BOOK

Calculus and Analytic Geometry *by* Thomas and Finney, 9th edition; *Publisher: Pearson Education*.

REFERENCE

1. Elementary Analysis: The Theory of Calculus *by* Kenneth Ross; *Publisher: Springer*
2. Principles of Mathematical Analysis by Walter Rudin (1976); 3rd edition; *Publisher: Paperback.*
3. Advanced Engineering Mathematics *by* Erwin Kreyszig, 8th edition; *Publisher: John Wiley*.
4. Calculus *by* Tom M. Apostol; Volume1 and Volume 2 (2003); 2nd edition; *Publisher: John Wiley*
5. Schaum's Outline of Vector Analysis *by* Murray R. Spiegel (2011); 2nd edition; *Publisher: Tata McGraw Hill*.

I Year B.Tech ME/ AE I sem	L	T/P/D	C
	3	0	3

(R11PHY1101) ENGINEERING PHYSICS I

UNIT I

Interference and diffraction

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; Distinction 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); Resolution of spectral lines; Rayleigh criterion; Resolving power of grating and telescope.

UNIT II

Polarization

Polarization phenomenon; Brewster's Law and Malus' law; Examples; Types of polarization; Double refraction; Nicol prism; Quarter and half wave plates.

Lasers

Characteristics of lasers – spontaneous and stimulated emission of radiation, meta stable state, population inversion, and lasing action; Einstein's coefficients and relation between them; Ruby laser; Helium-Neon laser; Carbon dioxide laser; Semiconductor Laser; Applications of lasers.

UNIT III

Fiber optics

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

Crystal structures

Space lattice; Unit cell; Lattice parameter; Crystal systems; Bravais lattices; Atomic radius; Co-ordination number; Structures and packing fractions of simple cubic – body centered cubic – face centered cubic crystals; Hexagonal closed packed crystals; Structures of diamond, NaCl.

UNIT IV

Directions, planes, and XRD

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; Applications of X-ray diffraction.

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.

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 V

Surface physics

Surface electronic structure (work function - thermionic emission, surface states, and tangential surface transport); Electron microscope; Scanning tunneling microscope.

Science and technology of nanomaterials

Origin of nanotechnology – Basic principles of Nanoscience and Technology; Surface to volume ratio; Quantum confinement; Fabrication of nanomaterials - bottom up fabrication (sol-gel and combustion methods), top down fabrication (CVD and PVD methods); Characterization (XRD and TEM); Applications of nanotechnology.

TEXT BOOKS

1. Introduction to Solid State Physics *by* Charles Kittel; *Publisher: John Wiley*
2. Physics, Vol.2, *by* Halliday, Resnick and Krane; *Publisher: John Wiley*
3. Applied Physics *by* P.K.Mittal; *Publisher: IK International Publishing House*.
4. Optics *by* A. Ghatak; *Publisher: Tata Mc Graw Hill*

REFERENCE

1. Engineering Physics *by* R.K.Gaur and S.L.Gupta; *Publisher: Dhanpat Rai*.
2. Solid State Physics *by* S.O.Pillai; *Publisher: New Age International.*
3. Engineering Physics *by* M Chandra Shekar and P. Appala Naidu; *Publisher: VGS Book links*.
4. Solid State Physics *by* A.J.Dekker; *Publisher: Macmillan Publishers*.
5. Solid State Physics *by* N.W.Ashcroft and N.David Merwin; *Publisher: Thomson Learning.*
6. Engineering Physics *by* Jain, Sanjay D. and Sahasrabudhe, Girish G.; *Publisher: Universities Press.*
7. Elements of Solid State Physics *by* J.P.Srivatsva; *Publisher: Prentice Hall of India.*
8. Optical Fiber Communications *by* G. Keiser; *Publisher: McGraw Hill*.
9. Fundamentals of Molecular Spectroscopy *by* Banwell; *Publisher: Tata McGraw Hill.*

I Year B.Tech ME/ AE I sem	L	T/P/D	C
	3	0	3

(R11CHE1102) CHEMISTRY OF ENGINEERING MATERIALS

UNIT I

Energy sources

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

UNIT II

Cement

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

UNIT III

Engineering materials

III a) Abrasives - Introduction, types of abrasives, working of abrasives, classification and chemical composition of abrasives, and their applications.

III b) Adhesives - Introduction, criteria of a good adhesive, classification of adhesives and their applications, advantages and disadvantages of adhesives.

UNIT IV

Refractories and Ceramics

Refractories: Definition; Classification with examples; Characteristics of a good refractory; Causes for the failure of a refractory material; Properties of refractories - refractoriness, RUL test, chemical inertness, dimensional stability, thermal expansion and contraction, thermal conductivity, porosity, electrical conductivity, heat capacity ,permeability, thermal spalling, and texture.

Ceramics: Introduction; Classification; Glazed ceramics; Applications of ceramics.

UNIT V

Lubricants

Criteria of a good lubricant; Classification of lubricants-lubricating oils; Greases or semisolid lubricants; Solid lubricants; Mechanism of lubrication-fluid film lubrication, boundary lubrication, and extreme pressure lubrication; Properties of lubricants - viscosity, cloudpoint, pour point, flash and fire point, mechanical stability, saponification number, neutralization number, aniline point, oiliness, and carbon residue.

TEXT BOOKS

1. Text book of Engineering Chemistry *by* Y.Bharathi Kumari and Jyotsna Cherukuri; *Publisher: VGS Book Links*.
2. Engineering Chemistry *by* P.C.Jain and Monica Jain; *Publisher: Dhanpatrai*.

REFERENCE

1. Text book of Engineering Chemistry *by* Balram Pani; *Publisher: Galgotia Publications.*
2. Text book of Engineering Chemistry *by* S.S. Dhara and Mukkanti; *Publisher: S.Chand.*
3. Text book of Engineering Chemistry *by* C.P.Murthy, C.V.Agrawal, and A.Naidu; *Publisher: B.S.Publications*.
4. Text book of Engineering Chemistry *by* R.Gopalan, D.Venkappayya, and Sulochana Nagarajan; *Publisher: Vikas Publishers*.

I Year B.Tech ME/ AE I sem	L	T/P/D	C
	3	0	3

(R11CSE1101) COMPUTER PROGRAMMING

UNIT I

Introduction to computers

Computer systems; Computing environments (DOS/Linux); Computer languages; Linux command for creating and running programs; Software development methods; Algorithms; Pseudo code; Flow charts; Applying the software development method.

UNIT II

Introduction to C language

History; Simple C programme; Identifiers; Basic data types; Variables; Constants; Type qualifiers; Input/ Output; Operators; Expressions - precedence and associativity, and expression evaluation; Type conversions; Bit wise operators; Statements; Simple C programming examples.

Selection statements – if and switch statements; Repetition statements – while, for, do-while statements, and loop examples; Other statements related to looping – break, continue, go to statements, and C Programming examples.

UNIT III

Designing structured programs

Functions – basics; user defined functions; inter-function communication, standard functions, and scope; Storage classes - auto, register, static, extern, and scope rules; Recursive functions; Example C programs.

Arrays – Basic concepts, one-dimensional arrays, two – dimensional arrays, multidimensional arrays, arrays to functions, C program examples.

Strings – Basic concepts, String input/ output functions, arrays of strings, string handling functions, strings to functions, C programme examples.

UNIT IV

Derived data types

Structures – basic concepts, nested structures, arrays of structures, structures and functions, unions, typedef, bit fields, enumerated types, and C programming examples.

Pointers

Basic concepts; Pointers and functions; Pointers and strings; Pointers and arrays; Pointers and structures; Self referential structures; Example C programs.

UNIT V

File I/O

Basic concepts; Text files and binary files; File input/ output operations; File status functions (error handling); Command-Line Arguments, C program examples.

Preprocessor directives.

Dynamic memory allocation.

TEXT BOOKS

1. C Programming: A Problem-Solving Approach *by* Behrouz A. Forouzan, Richard F.Gilberg, and E.V.Prasad; *Publisher: Cengage Learning.*
2. The C Programming Language *by* Brian W. Kernighan and Dennis M. Ritchie; *Publisher: Prentice Hall*.

REFERENCE

1. Let us C *by* Yashavant Kanetkar; *Publisher: BPB Publications*
2. C: How to Program *by* Paul Deitel and Harvey Deitel; *Publisher: Prentice Hall*
3. Absolute Beginner's Guide to C *by* Greg M. Perry, Edition 2; *Publisher: Sams Pub., 1994*

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

(R11MED1101) ENGINEERING MECHANICS I

UNIT I

Concurrent forces in a plane

Principles of statics; Composition and resolution of forces; Equilibrium of concurrent forces in a plane; Method of projections; Equilibrium of three forces in a plane; Method of moments; Friction.

UNIT II

Parallel forces in a plane

Two parallel forces; General case of parallel forces in a plane; Center of parallel forces and center of gravity; Centroids of composite plane figures and curves; Distributed force in a plane.

UNIT III

General case of forces in a plane

Composition of forces in a plane; Equilibrium of forces in a plane; Plane trusses: Method of joints; Plane trusses: Method of sections; Plane frames: Method of members; The funicular polygon; Maxwell diagrams; Distributed force in a plane; Flexible suspension cables.

UNIT IV

Force systems in space

Concurrent forces in space - method of projections, and method of moments; Couples in space; Parallel forces in space; Center of parallel forces and center of gravity; General case of forces in space.

UNIT V

Moments of inertia of a plane figure

Moment of inertia of a plane figure with respect to an axis in its plane; Moment of inertia of a plane figure with respect to an axis perpendicular to the plane of the figure; Parallel-axis theorem; Product of inertia and principal axes; Principal axes and principal moments of inertia.

Moments of inertia of material bodies

Moments of inertia of a rigid body; Moment of inertia of a lamina; Moment of inertia of three-dimensional bodies; Product of inertia and principal axes; Change of direction of axes of inertia.

TEXT BOOK

Engineering Mechanics *by* S.Timoshenko and D.H.Young; *Publisher: McGraw Hill*

I Year B.Tech ME/ AE I sem	L	T/P/D	C
	3	0	3

(R11EEE1130) ELEMENTS OF ENGINEERING

ELEMENTS OF CIVIL ENGINEERING

UNIT I

Construction and facilities

Introduction - Impact of Infrastructural development on the economy of a country, role of civil engineers, importance of planning, scheduling in construction management;

Surveying - linear measurements, elevation measurements, areas, volumes, modern tools of surveying like total station, GPS, and GIS;

Construction materials - Importance of civil engineering materials like stones, bricks, cement, timber, reinforcing steel, paints, glass in construction;

Soils and foundations - Types of soils, SBC of soils, suitable foundations for structures like buildings; bridges and towers;

Roads and highways - camber, stopping sight distance, overtaking sight distance, BOT projects;

Planning of buildings - building byelaws and regulations, planning of residential and commercial facilities like institutes, hospitals, shopping malls, and theatres;

Dams and Reservoir - water requirements and its conservation, hydraulic structures of storage and water conveyance systems.

ELEMENTS OF MECHANICAL ENGINEERING

UNIT II

Power (energy) systems

Block diagram of a power system; sources of energy; Conventional, non-conventional and renewable energy; Application; Resource availability; Power produced; Torque, Speed, and Efficiency; Materials used in turbine shafts; Blades; Nozzles; Diagnostics and condition monitoring; Commercial feasibility of power systems.

(Turbine)

UNIT III

Transport vehicles (surface and air)

Road Vehicles - power plant in vehicles, transmission; steering, chassis, body, and wheels and axles

Rail vehicles - distinction of rail vehicles from road vehicles;

Air vehicles - aeroplane and its parts;

Space vehicles - rockets, 2 stage, 3 stage and 4 stage rockets, and solid and liquid fuels;

Sea Vehicles – power plant, transmission, steering, and hull.

ELEMENTS OF ELECTRICAL ENGINEERING

UNIT IV

Electrical power systems

Electrical power generation concept; A.C generator-principle; Steam power plant (thermal power plant); Hydel power plant (layouts only); Efficiency-transformer-principle-need-types; Fuse-Substation-simple problems.

UNIT V

Utilization of electrical energy

Electrical heating-advantages; Resistance heating; Illumination; Definitions; Laws of illumination; Working of Incandescent lamp and Fluorescent lamps; Electric Welding; Electric Traction-Block diagram; Simplified speed-time curve; Energy meter (principle only).

TEXT BOOKS

1. Electrical Engineering Fundamentals *by* Vincent Deltora, Prentice Hall of India, 2nd edition.
2. Art and Science of Utilization of Electrical Energy *by* H.Partab; *Publisher: Dhanpat Rai.*
3. Non-Conventional Energy Sources *by* G.D. Roy; *Publisher: Khanna Publishers.*
4. Automotive Mechanics *by* William Crouse and David Anglin; *Publisher: McGraw Hill*

REFERENCE

1. A Course in Utilization of Electrical Energy *by* S.K. Girdhar, G.C. Garg, and S.M. Dhir; *Publisher: Khanna Publishers.*
2. Electrical Power Systems *by* Soni, Gupta, and Batnagar; *Publisher: Dhanpat Rai.*
3. Generation, Distribution and Utilization of Electrical Energy *by* C.L. Wadhwa; *Publisher: New Age International.*

I Year B.Tech ME/ AE I sem	L	T/P/D	C
	2	3	2

(R11MED1102) ENGINEERING GRAPHICS I

UNIT I

Introduction to AutoCAD.

Introduction to engineering drawing

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

UNIT II

Curves used in engineering practice and their construction

Ellipse; Parabola; Hyperbola and rectangular hyperbola; Cycloid; Epicycloids; Hypocycloid – involutes.

UNIT III

Orthographic projection

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 BOOK

Elementary Engineering Drawing *by* N.D. Bhat; *Publisher: Charotar Publishing House*

REFERENCE

Engineering Drawing *by* K.L. Narayana and P. Kannaiah; *Publisher: Scitech Publications.*

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

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

(R11EPC1201) ENGINEERING PHYSICS AND CHEMISTRY LAB

ENGINEERING PHYSICS LABORATORY

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 ring.
5. Finding thickness of a thin wire or sheet by forming a wedge-shaped film.
6. Energy gap of a semiconductor material.
7. Torsional pendulum expt. to determine the rigidity modulus of material of a wire.
8. Melde's experiment.
9. Sonometer experiment.
10. Numerical aperture and acceptance angle of an optical fiber cable.
11. Stewart Gee's experiment.
12. Characteristics of LED.
13. Photo cell/ solar cell.

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

ENGINEERING CHEMISTRY: LIST OF EXPERIMENTS

1. Titrimetry

a) Estimation of hardness of water by EDTA method.

2. Instrumental methods

(i) Conductometry

a) Conductometric titration of strong acid vs strong base

(ii) Colorimetry

a) Estimation of copper by colorimetric method

(iii) Potentiometry

a) Titration of strong acid vs strong base by potentiometry

3. Physical properties

a) Determination of viscosity of sample oil by Redwood viscometer.

4. Preparation of organic compounds

a) Preparation of aspirin or Thiokol rubber

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*.

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

(R11CSE1201) COMPUTER PROGRAMMING LABORATORY

Week 1

1. Write a program using C (WAP) that reads three different integers from the keyboard and prints – sum, average, product, smallest, and largest of the numbers.
2. WAP 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. WAP to find the sum of individual digits of a positive integer.
2. WAP to generate Fibonacci sequence (1, 1, 2, 3, 5, 8,….).
3. WAP to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Week 3

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

Week 4

1. WAP 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. WAP to construct pyramids of numbers.

Week 5

1 WAP to print a given number [0-1000] in words. For example, 123 as “One Hundred and Twenty Three”.

2 WAP to check whether a given number is an Armstrong, Palindrome, Perfect, Prime, or a Fibonacci prime number.

3 WAP to find both the largest and smallest number in a list of integers.

Week 6

1. Implementation of functions categories.
2. 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.

Week 7

1. WAP to calculate
   i) minimum and maximum of an 1-d array.
   ii) sorting and searching of 1-D array.
   iii) addition and multiplication of two matrices

Week 8

1. Programs on string handling functions-copying, reverse, substring, concatenation.

2. Programs on structure and unions.

Week 9

Midterm exam

Week 10

Programs using pointers - pointer basic operations, and pointers and functions.

Week 11

Program on pointers and structures, pointers and arrays, and pointers and strings.

Week 12

Implementation of file operations and error handling.

Week 13

Implementation of dynamic memory allocation.

Week 14

Programs using command line arguments.

Week 15

Implementation of preprocessor directives.

Week 16

Internal Lab Exam

I Year B.Tech ME/ AE II sem	L	T/P/D	C
	3	1	3

(R11MTH1102) MATHEMATICS II

(Linear Algebra and Ordinary Differential Equations)

LINEAR ALGEBRA

UNIT I

Solution of linear systems

Matrices and linear systems of equations - elementary row transformations, Rank Echelon form, and normal form; Solution of linear systems - direct methods - LU decomposition, LU decomposition from Gauss elimination, and solution of Tri-diagonal systems; Eigen values, eigen vectors, and their properties - Liner dependence and independence; Cayley-Hamilton theorem - inverse and powers of a matrix by Cayley-Hamilton theorem, diagonalization of a matrix, calculation of powers of a matrix; Modal and spectral matrices.

UNIT II

Linear transformations

Real matrices - symmetric, skew symmetric, and orthogonal linear transformation; Complex matrices - Hermitian, Skew-Hermitian and unitary matrices; Eigen values and eigen vectors of complex matrices and their properties; Quadratic forms - reduction of quadratic form to canonical form, rank, positive, negative definite, semi definite, index, signature, Sylvester law, and singular value decomposition.

ORDINARY DIFFERENTIAL EQUATIONS

UNIT III

Ordinary differential equations and their applications

Differential equations of first order and first degree - Linear, Bernoulli and exact 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.

UNIT IV

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 bending of beams; Mechanical systems - simple harmonic motion.

UNIT V

Linear differential equations and qualitative methods

Cauchy's linear differential equation; Legendre's differential equations; Simultaneous linear differential equations; The phase plane; Phase portraits and direction fields; Critical points and stability.

TEXT BOOKS

1. Advanced Engineering Mathematics *by* R.K Jain and S.R.K Iyengar, 3rd edition; *Publisher: Narosa Publications*, 2011.
2. Differential Equations *by* Dennis G. Zill; *Publisher: Cengage learning*, 2011.

REFERENCE

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. Elementary Differential Equations and Boundary Value Problems *by* William E. Boyce and Richard C. Diprima; *Publisher: Wiley.*
4. Linear Algebra and its applications by David C Clay; *Publisher: Pearson Education.*
5. Differential Equations, with Applications and Historical Notes *by* George F. Simmons and John S. Robertson (2008) 2nd Edition; *Publisher: Tata McGraw Hill*.
6. Advanced Engineering Mathematics *by* Dennis G. Zill, Warren S. Wright, and Michael R. Cullen, 4th edition; *Publisher: Jones and Bartlett Learning*.

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

(R11PHY1102) ENGINEERING PHYSICS II

UNIT I

Elements of statistical mechanics

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

Principles of quantum mechanics

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

UNIT II

Free electron Fermi gas

Energy levels in one dimension; Effect of temperature on the Fermi-Dirac distribution; Free electron gas in three dimensions; Electrical conductivity and Ohm's law; Electrical resistivity of metals (Qualitative); Thermal conductivity of metals.

Band theory of solids

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

UNIT III

Semiconductor physics

Fermi level in intrinsic and extrinsic semiconductors; Intrinsic semiconductor and carrier concentration; Extrinsic semiconductor and carrier concentration; Equation of continuity; Direct and indirect band gap semiconductors; Hall effect.

Physics of semiconductor devices

Formation of P-N junction; Open circuit P-N junction; Energy diagram of diode; I/ V characteristics of P-N junction diode; P-N diode as a rectifier; Diode equation; LED.

UNIT IV

Magnetic properties

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; Properties of anti ferro and ferri magnetic materials – ferrites and their applications.

UNIT V

Superconductors

Experimental survey and superconductivity phenomenon; Meissner effect; Critical fields and Persistent currents; Type I and Type II superconductors; London equations; Flux quantization; BCS theory; Josephson effect; High temperature superconductors; Applications of superconductors.

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.

TEXT BOOKS

1. Introduction to Solid State Physics *by* Charles Kittel; *Publisher: John Wiley* (for UNITS II to V)
2. Concepts of Modern Physics *by* Arthur Beiser; *Publisher: McGraw Hill Inc*.
3. Applied Physics *by* P.K.Mittal; *Publisher: IK International Publishing House*.

REFERENCE

1. Solid State Physics *by* S.O.Pillai; *Publisher: New Age International.*
2. Solid State Physics *by* A.J.Dekker; *Publisher: Macmillan Publishers.*
3. Engineering Physics *by* M. Chandra Shekar and P. Appala Naidu; *Publisher: VGS Book links*.
4. Solid State Physics *by* N.W. Ashcroft and N. David Merwin; *Publisher: Thomson Learning.*
5. Engineering Physics *by* Jain, Sanjay D. and Sahasrabudhe, Girish G.; *Publisher: Universities Press.*
6. Elements of Solid State Physics *by* J.P.Srivatsva; *Publisher: Prentice Hall of India*
7. Engineering Physics *by* M.R.Srinivasan; *Publisher: New Age International.*

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

(R11CHE1101) ENGINEERING CHEMISTRY

UNIT I

Electrochemical cells and batteries

Cell representation; Galvanic cells; Single electrode potential; Standard electrode potential; Electrochemical series; Nernst equation; Concentration cells; Reference electrodes – hydrogen, calomel, quinhydrone electrode; Ion selective electrodes (glass electrode and flouride electrode); Numerical problems.

Batteries

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

UNIT II

Corrosion and its control

Introduction; Causes and effects of corrosion; Different types of corrosion; Theories of corrosion – chemical, electrochemical corrosion (reactions); Factors affecting corrosion – nature of metal (galvanic series; over voltage; purity of metal; nature of oxide film; nature of corrosion product), and nature of environment (effect of temperature; effect of pH; humidity; effect of oxidant).

Corrosion control methods – cathodic protection, sacrificial anode, and impressed current cathode;

Surface coatings – methods of application on metals (hot dipping; galvanizing; tinning; cladding; electroplating), organic surface coatings (paints - constituents and functions).

UNIT III

Polymers

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

Rubber

Characteristics and uses of rubber - natural rubber, and vulcanization; Elastomers (Buna-s; Butyl rubber; thiokol rubbers); Fibers – polyester; Fiber reinforced plastics (FRP) and their applications.

UNIT IV

Water

Introduction; Hardness - causes, expression of hardness, units, types of hardness, estimation of temporary and permanent hardness of water, and numerical problems; Boiler troubles – scale and sludge formation, caustic embrittlement, corrosion, priming and foaming; Softening of water (Internal and external treatment - lime soda, zeolite, ion

exchange process, and numerical problems); Reverse osmosis and Electro dialysis (desalination processes).

UNIT V

Nanomaterials

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

Insulators

Classification of insulators; characteristics of thermal and electrical insulators and their applications; Superconductors - Nb-Sn alloy, $YBa_2Cu_3O_{7-x}$; Applications of superconductors.

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 and Monica Jain, *Publisher: Dhanpatrai Publishing Company*.

REFERENCE

1. Text Book of Engineering Chemistry by S.S. Dhara and Mukkanti; *Publisher: S.Chand*.
2. Text Book of Engineering Chemistry by C.P.Murthy, C.V.Agrawal, and A.Naidu; *Publisher: B.S.Publications.*
3. Text Book of Engineering Chemistry *by* R.Gopalan, D.Venkappayya, and Sulochana Nagarajan; *Publisher: Vikas Publishers*.

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

(R11HAS1101) ENGLISH

Introduction

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

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

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

Objectives

i) To equip the students with all the LSRW skills for advanced writing and speaking.
ii) To equip the students with basic grammar, infrastructural patterns and grammatical constructions required of in technical writing.
iii) To acquaint the students with the writing process, beginning with paragraph writing. This would prepare them for academic and workplace writing.
iv) Equip the students with Oral Communication Skills.

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

Prose:

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

UNIT II

Basic grammar

i) Common errors v) Use of articles and prepositions

ii) Subject-Verb agreement
iii) Adverbs
iv) Transitional elements
vi) Conjunctions
vii) Pronoun reference

UNIT III

Reading and writing skills

i) Reading comprehension
ii) Paragraph writing
iii) Letter writing
iv) Memo writing
v) Words often confused
vi) Synonyms and antonyms
vii) One word substitutes
viii) Prefixes and suffixes
ix) Idioms and phrases

UNIT IV

Prose

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

UNIT V

Technical writing component

A. Definition of a Technical Term
B. Description of a Mechanism
C. Description of a Technical Process
D. Classification
E. Cause and Effect
F. Comparison and Contrast
G. Analogy

TEXT BOOKS

1. Effective Technical Communication *by* M. Ashraf Rizvi; Publisher: Tata McGraw Hill.
2. Technical Communication: Principles and Practices *by* M. Raman and S. Sharma; *Publisher: Oxford University Press, 2004 (Indian Edition).*

REFERENCE

1. Technical Writing Process and Product *by* Gerson Sharon J. and Steven Gerson, 3rd edition; *Publisher: Prentice Hall* 1999
2. Blanton, L.L. 1993; Composition Practice, Book 4 ,Second Edition; *Publisher: Heinle and Heinle Publishers*, pp. 54
3. Georges, T.M. 1996; A course in Analytical Writing for Science and Technology, http://www.mspiggy.etl.noaa.gov/write/
4. Oxford English for Electrical and Mechanical Engineering *by* E.H.Glendinning, and N.Glendinning, 1995, pp.28,68,83; *Publisher: Oxford University Press*.
5. Greaney, G.L. 1997; Less is More: Summary Writing and Sentence Structure in the Advanced ESL Classroom, The Internet TESL Journal, Vol.III, No.9; http://iteslj.org/Techniques/Greaney-Writing.html
6. A Handbook for Technical Communication *by* J.K. Neufeld, 1987; *Publisher: Prentice Hall*.

7. Principles of Course Design for Language Teaching, *by* J. Yalden, 1987; *Publisher: Cambridge University Press.*
8. A Guide to Writing as an Engineer *by* David F. Beer and David McMurrey; 2nd / 3rd edition, *Publisher: Wiley.*
9. Applied Writing for Technicians *by* Dale Jungk; *Publisher: McGraw Hill*.
10. A Pocket Style Manual *by* Diane Hacker, 2003; *Publisher: Bedford/ St. Martin's*.

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

(R11CSE1102) DATA STRUCTURES

UNIT I

Introduction to data structures.

Abstract data types.

Linear lists

Singly linked list implementation - insertion, deletion, and searching operations on linear list; Circular linked list implementation; Double linked list implementation - insertion, deletion and searching operations; Applications of linked lists.

UNIT II

Stacks

Operations; Array and linked representations of stacks; Stack applications - infix to postfix conversion, postfix expression evaluation, and recursion implementation.

UNIT III

Queues

Operations; Array and linked representations; Circular queue operations; Dequeues; Applications of queues.

UNIT IV

Trees

Definitions; Binary tree representation; Binary search tree; Binary tree traversals.

Graphs

Definitions; Graph representations; Graph traversals.

UNIT V

Searching and sorting

Big O notation;

Searching - linear and binary search methods;

Sorting - selection sort, bubble sort, insertion sort, quick sort, and merge sort.

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TEXT BOOKS

1. C Programming and Data Structures *by* B.A.Forouzan and R.F. Gilberg, Third Edition, *Publisher: Cengage Learning*.
2. Data Structures Using C (Paperback) *by* Aaron M. Tenenbaum; *Publisher: Pearson Education.*

REFERENCE

1. C and Data structures *by* P. Padmanabham, Third Edition; *Publisher: B.S. Publications*.
2. Data Structures using C and C++ *by* A.M.Tanenbaum, Y.Langsam, and M.J. Augenstein; *Publisher: Pearson Education/ Prentice Hall*

3. C Programming and Data Structures *by* E. Balagurusamy; *Publisher: Tata McGraw Hill.*
4. Computer Programming and Data Structures *by* P. Dey, M. Ghosh R. Thareja; *Publisher: Oxford University Press.*
5. C and Data structures *by* E V Prasad and N.B. Venkateswarlu; *Publisher: S. Chand*.

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

(R11MED1103) ENGINEERING MECHANICS II

UNIT I

Principle of virtual work

Equilibrium of ideal systems; Efficiency of simple machines; Stable and unstable equilibrium.

UNIT II

Rectilinear translation

Kinematics of rectilinear motion; Principles of dynamics; Differential equation of rectilinear motion; Motion of a particle acted upon by a constant force; Force as a function of time; Force proportional to displacement - free vibrations; D' Alembert's principle; Momentum and impulse; Work and energy; Ideal systems; Conservation of Energy; Impact.

UNIT III

Curvilinear translation

Kinematics of curvilinear motion; Differential equations of curvilinear motion; Motion of a projectile; D' Alembert's principle in curvilinear motion; Moment of momentum; Work and energy in curvilinear motion.

UNIT IV

Rotation of a rigid body about a fixed axis

Kinematics of rotation; Equation of motion for a rigid body rotating about a fixed axis; Rotation under the action of a constant moment; Torsional vibration; The compound pendulum; General case of moment proportional to angle of rotation; D' Alembert's principle in rotation; Resultant inertia force in rotation; The principle of angular momentum in rotation; Energy equation for rotating bodies; Gyroscopes.

UNIT V

Plane motion of a rigid body

Kinematics of plane motion; Instantaneous center; Equations of plane motion; D' Alembert's principle in plane motion; The principle of angular momentum in plane motion; Energy equation for plane motion.

TEXT BOOK

Engineering Mechanics *by* S.Timoshenko and D.H.Young; *Publisher: McGraw Hill.*

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

(R11MED1104) ENGINEERING GRAPHICS II

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

Tranformation of projections

Conversion of isometric views to orthographic views-conventions and vice versa.

UNIT V

Perspective projections

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

TEXT BOOK

Elementary Engineering Drawing *by* N.D.Bhat; *Publisher: Charotar Publishing House*

REFERENCE

Engineering Drawing *by* K.L. Narayana and P. Kannaiah; *Publisher: Scitech Publications.*

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

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

(R11MED1201) ENGINEERING WORKSHOP

Mechanical Part (12 weeks)

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.

IT Workshop (4 weeks)

Computer hardware: identification of parts, assembling, and disassembling.

Installation of operating system: windows, linux – basic commands.

TEXT BOOKS

1. Workshop Manual *by* P.Kannaiah and K.L.Narayana; *Publisher: Scitech*.
2. IT Essentials: PC Hardware and Software Companion Guide, Third Edition *by* David Anfinson and Kenneth Quamme; *Publisher: CISCO Press/ Pearson Education*.
3. PC Hardware and A+ Handbook *by* Kate J. Chase; *Publisher: Microsoft press.*

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

(R11HAS1203) ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY

The English Language Communication Skills Lab. aims to provide practice in all the four skills of LSRW, and provide ample practice in listening and speaking skills.

Syllabus for Lab. Sessions

UNIT I

Multimedia Lab

1. Phonetics
2. Listening comprehension
3. Vocabulary Lesson 1

Oral Communication Skills Lab: Self Introduction; E-mail

UNIT II

Multimedia Lab

1. Grammar ---Nouns and Pronouns; The Present Tense
2. Vocabulary Lesson 2
3. Listening Skills

Oral Communication Skills Lab: Role Play/ Situational Dialogues

UNIT III

Multimedia Lab

1. Telephoning Skills
2. Grammar --- Articles; The Past Tense
3. Vocabulary Lesson 3

Oral Communication Skills Lab: JAM/ Short Talk

UNIT IV

Multimedia Lab

1. Grammar ---- Concord; The Future Tense
2. Vocabulary Lesson 4
3. Listening Comprehension

Oral Communication Skills Lab: Information Transfer

UNIT V

Multimedia Lab

1. Grammar --- Adjectives, adverbs, conjunctions
2. Vocabulary -- Lesson 5

Oral Communication Skills Lab: Presentation Skills

MULTIMEDIA LAB REQUIREMENTS

Minimum Requirement

The English Language Lab shall have two parts:

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

ii) **The Communication Skills Lab** with movable chairs and audio-visual aids with a P.A System,

iii) a T. V., a digital stereo –audio and video system and camcorder etc.

System Requirement (Hardware component)

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

iv) **P – IV Processor**

a) Speed – 2.8 GHZ
b) RAM – 512 MB Minimum
c) Hard Disk – 80 GB

v) Headphones of High quality

Suggested Software

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

- Clarity Pronunciation Power – part II
- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dreamtech
- TOEFL and GRE (KAPLAN, AARCO and BARRONS, USA, Cracking GRE by CLIFFS)

II Year B.Tech AE I sem	L	T/P/D	C
	3	1	3

(R11MTH1103) MATHEMATICS III

(Partial Differential Equations and Integral Transforms)

PARTIAL DIFFERENTIAL EQUATIONS

UNIT I

Partial differential equations

Introduction and formation of partial differential equations by elimination of arbitrary constants and arbitrary functions; Solutions of first order linear (Lagrange's) equation and non-linear (standard type) equations; Method of separation of variables for second order equations; Particular integrals; Monge's method for solving Rr+ Ss+ Tt = V

INTEGRAL TRANSFROMS

UNIT II

Laplace transform

Laplace transform of standard functions; Inverse transform-first shifting theorem; Dirac's delta function; Convolution theorem; Periodic function; Differentiation and integration of transforms; Application of Laplace transforms to ordinary differential equations.

UNIT III

Fourier series

Determination of Fourier coefficients; Fourier series - even and odd functions; Fourier series in an arbitrary interval; Even and odd periodic continuation; Half range Fourier series sine and cosine expansions; Fourier integral theorem (only statement); Fourier sine and cosine integrals; Fourier transforms; Fourier sine and cosine transforms; Properties; Inverse transforms-finite Fourier transforms.

UNIT IV

Application of transform (Laplace and Fourier)

Solutions of wave equation, heat equation and Laplace equation and their use in problems of vibrating string; One dimensional unsteady heat flow; Two dimensional steady heat flow.

UNIT V

Z-Transform

z-transform; Inverse z-transform; Properties, initial, and final value theorems; Convolution theorem; Difference equations; Solutions of difference equations using z-transform.

TEXT BOOKS

1. Advanced Engineering Mathematics *by* R.K Jain and S.R.K Iyengar, 3rd edition; *Publisher: Narosa Publications*, 2011.
2. Elements of Partial Differential Equations *by* Ian Naismith Sneddon; *Publisher: Dover Publications.*

REFERENCE

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. Advanced Engineering Mathematics *by* Dennis G. Zill and Warren S. Wright; 4th edition; *Publisher: Jones and Bartlett Learning*.

II Year B.Tech AE I sem	L	T/P/D	C
	4	1	4

(R11MED1106) MECHANICS OF SOLIDS I

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; Displacement diagrams; Statically indeterminate structures (flexibility method and stiffness method); Temperature and prestrain effects; Stresses on inclined sections; Strain energy; Dynamic loading; Overview of nonlinear behavior.

UNIT II

Torsion

Introduction; Torsion of circular bars; Nonuniform torsion; Pure shear; Relationship between moduli of elasticity E and G; Transmission of power by circular shafts; Statically indeterminate torsional members; Strain energy in pure shear and torsion.

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.

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; Shear stresses in rectangular beams; Shear stress in webs of beams with flanges; Shear stress in circular beams (solid and hollow sections); Built-up beams; Overview of stresses in nonprismatic beams.

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; Triaxial stress; Volumetric strain; Three dimensional stress; Overview of plane strain.

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; Nonprismatic beams; Strain energy in bending; Overview of discontinuity functions.

TEXT BOOK

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

REFERENCE

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

Strength of Materials *Schaum's Series..*

II Year B.Tech AE I sem	L	T/P/D	C
	4	1	4

(R11MED1107) THERMODYNAMICS

UNIT I

Introduction

Various applications of thermodynamics.

Control volumes and units (concepts and definitions)

A thermodynamic system and the control volume; Macroscopic versus microscopic point of view; Properties and state of a substance; Processes and cycles, units for mass, length, time, and force; Energy; Specific volume and density; Pressure; Equality of temperature; The Zeroth law of thermodynamics; Temperature scales; Engineering applications.

Properties of a pure substance

The pure substance; Vapor- liquid- solid- phase equilibrium in a pure substance; Independent properties of a pure substance; Tables of thermodynamic properties; Thermodynamic surfaces; The P-V-T behavior of low- and moderate- density gases; The compressibility factor; Equations of state; Introduction to computerized tables; Engineering applications.

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; Remarks regarding work; Definition of heat; Heat transfer modes; Comparison of heat and work; Engineering applications.

UNIT II

Energy equation for a control mass (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; The thermodynamic property 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; Conversion of mass; Engineering applications.

Energy equation for a control volume (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; Engineering applications.

UNIT III

The (classical) 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; Engineering applications.

Entropy for a control mass

The inequality of Clausius; Entropy – a property of a system; The entropy of a pure substance; Entropy of a pure substance, Entropy change in reversible processes; The thermodnamic 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 the increase of entropy; Entropy as ya rate equation; Some general comments about entropy and chaos.

Entropy equation for a control volume (Second law analysis for a control volume)

The second law of thermodynamics for a control volume; The stead–state process; The steady-state single flow process; Principle of the increase of entropy; Engineering applications; Efficiency.

UNIT IV

Irreversibility and Availability

Available energy; Reversible work, and irreversibility; Availability and second-law efficiency; Energy balance equation; Engineering applications.

Power and refrigeration systems-with phase change (Cycles)

Introduction to power systems; The Rankine cycle; Effect of pressure and temperature on the Rankine cycle; Introduction to refrigeration systems; The vapour-compression refrigeration cycle.

Power and refrigeration systems-gaseous working fluids

Air-standard power cycles; The Brayton cycle; The simple gas-turbine cycle with a regenerator; The air-standard cycle for jet propulsion; Reciprocating engine power cycles; The Otto cycle; The diesel cycle; The Stirling cycle; The Atkinson and Miller cycles; Combined cycle power and refrigeration systems.

UNIT V

(Ideal) Gas mixtures

General consideration and mixtures of ideal gases; A simplified model of a mixture involving gases and a vapor; The first law applied to gas-vapor mixtures; The adiabatic saturation process; Engineering applications: Wet-bulb and dry- bulb temperatures and overview of psychrometric chart.

Thermodynamic (property) relations

The Clapeyron equation; Mathematical relations for a homogeneous phase; The Maxwell relations; Thermodynamic relations involving enthalpy, internal energy, and entropy; Volume expansivity, and isothermal and adiabatic compressibility; Real gas behavior and equations of state; The generalized chart for changes of enthalpy at constant temperature; The generalized chart for changes of entropy at constant temperature; The property relation for mixtures; Pseudopure substance models for real-gas mixtures; Tables of thermodynamic properties.

TEXT BOOK

Fundamentals of Thermodynamics *by* C. Borgnakke and R.E. Sonntag; *Publisher: John Wiley*.

REFERENCE

1. Fundamentals of Thermodynamics *by* C. Borgnakke, R.E. Sonntag, and G.J. Van Wylen; *Publisher: John Wiley*.
2. Engineering Thermodynamics by P.K.Nag.
3. Thermodynamics – An engineering approach by Yunus Cengel and Boles; *Publisher: TMH*.

II Year B.Tech ME I sem	L	T/P/D	C
	3	0	3

(R11MED1108) METALLURGY AND MATERIAL SCIENCE

UNIT I

Metal structure and crystallization

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

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; Substitutional 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-Fe3C.

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.

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, molybdinum steels, tungsten steels, venedium steels, silicon steels, stainless steels, martensitic stainless steels, ferritic stainless steels, austenitic stainless steels, precipitation-hardening stainless steels, maraging steels, and ausforming.

Tool steels

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

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

UNIT V

Cast iron

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

Non-ferrous metals and alloys

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

Overview of solidification of metals

TEXT BOOK

Introduction to Physical Metallurgy by Sidney H. Avner; *Publisher: McGrawHill*.

REFERENCE

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

II Year B.Tech. AE I sem	L	T/P/D	C
	3	1	3

(R11MED1112) FLUID MECHANICS AND TURBOMACHINERY

UNIT I

Fluid properties

Definitions: Definition of a fluid, force, mass, length, and time units; Viscosity; Continuum; Density, specific volume, unit gravity force, relative density, pressure, and perfect gas; Bulk modulus of elasticity; Vapor pressure; Surface tension.

Fluid statics

Pressure at a point; Basic equation of fluid statics; Units and scales of pressure measurement; Manometers; Forces on plane areas; Force components on curved surfaces; Buoyant force; Stability of floating and submerged bodies; Relative equilibrium.

Fluid-flow concepts and basic equations

Flow characteristics – definitions; The concepts of system and control volume; Application of the control volume to continuity, energy and momentum; Continuity equation; Euler's equation of motion along a streamline; The Bernoulli equation.

UNIT II

Fluid-flow concepts and basic equations (contd)

The steady state energy equation; Application of the energy equation to steady fluid flow situations; Applications of the linear momentum equation; The moment-of-momentum equation.

Dimensional analysis and dynamic similitude

Dimensional homogeneity and dimensionless ratios; Dimensions and units; The π-theorem; Discussion of dimensionless parameters; Similitude – model studies.

Viscous effects – fluid resistance

Laminar, incompressible, steady flow between parallel plates; Laminar flow through circular tubes and circular annuli; the Reynolds number; Prandtl mixing length - velocity distribution in turbulent flow; Transport phenomina; Boundary-layer concepts; Drag on immersed bodies.

UNIT III

Fluid measurement

Pressure measurement; Velocity measurement; positive-displacement meters; Orifices; Venturimeter, nozzle, and other rate devices; Overview of measurement of turbulence; Measurement of viscosity.

Turbo machinery

Introduction to turbomachinery; Homologous units; Specific speed; Elementary cascade theory; Theory of turbomachines.

UNIT IV

Turbo machinery

Reaction turbines; Pumps and blowers; Impulse turbines; Cavitation.

UNIT V

Viscous effects – fluid resistance (Contd)

Resistance to turbulent flow in open and closed conduits; Overview of steady uniform flow in open channels; Overview of Steady incompressible flow through simple pipe systems

Steady closed conduit flow

Exponential pipe friction formulas; Hydraulic and energy grade lines; The siphon; Pipes in series; Pipes in parallel; Branching pipes; Networks of pipes.

Introduction to compressible flow, perfect gas relationships, speed of sound wave, Mach number

TEXT BOOK

1. Fluid Mechanics (First SI Metric Edition) *by* V.L. Streeter and E.B. Wylie, *Publisher: McGraw Hill*.
2. Fluid Mechanics (Third edition; International Student Edition) *by* V.L. Streeter; *Publisher: McGraw Hill and Kogakusha*.

REFERENCE

1. Schaum's outline of Fluid Mechanics; *Publisher: TMH.*
2. Fluid Mechanics *by* F.M.White; *Publisher: McGraw Hill*.
3. Fluid Mechanics and Fluid Power Engineering *by* D.S. Kumar
4. Fundamentals of Compressible Flow *by* S.M.Yahya; *Publisher: New Age International.*

II Year B.Tech AE I sem	L	T/P/D	C
	0	6	4

(R11MED1109) MACHINE DRAWING

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.
f) Production drawings

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. Part and 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.
c) Valves - steam stop valve.

III. Production drawings

a) Overview of limits, fits, tolerances, geometrical accuracy, surface roughness symbols, welding symbols etc.
b) Production drawings of piston assembly and tailstock.

NOTE

1. To adopt first angle of projection.

2. The student should be able to provide working drawings of actual parts.

TEXT BOOK

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

REFERENCE

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

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

(R11MED1203) METALLURGY LAB AND MECHANICS OF SOLIDS LAB

Metallurgy lab.

1. Preparation and study of the microstructure of pure 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. Hardeneability of steels by Jominy end quench test.
7. To find out the hardness of various treated and untreated steels.

Mechanics of solids lab.

1. Direct tension test
2. Bending 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

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

(R11MED1205) MECHANICS OF FLUIDS AND TURBOMACHINERY LAB

1. Impact of jets on vanes.
2. Performance test on pelton wheel.
3. Performance test on francis turbine.
4. Performance test on kaplan turbine.
5. Performance test on single stage centrifugal pump.
6. Performance test on multi stage centrifugal pump.
7. Performance test on reciprocating pump.
8. Calibration of venturimeter.
9. Calibration of orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Turbine flow meter.

II Year B.Tech. AE II sem	L	T/P/D	C
	4	1	4

(R11MED1110) MECHANICS OF SOLIDS II

UNIT I

Statically indeterminate beams

Statically indeterminate beams; Analysis by differential equations of the deflection curve; Moment-area method; Method of superposition (flexibility method); Continuous beams; Temperature effects; Horizontal displacements at the ends of a beam.

UNIT II

Unsymmetric bending

Introduction; Doubly symmetric beams with skew loads; Pure bending of unsymmetric beams; Generalized theory of pure bending; Bending of beams by lateral loads; Shear centre; Shear stresses in beams of thin-walled open cross sections; Shear centers of thin-walled open sections; General theory for shear stresses.

UNIT III

Inelastic bending

Introduction; Equations of inelastic bending; Plastic bending; Plastic hinges; Plastic analysis of beams; Deflections; Inelastic bending; Residual stresses.

UNIT IV

Columns

Buckling and stability; Columns with pinned ends; Columns with other support conditions; Columns with eccentric axial loads; Secant formula; Imperfections in columns; Elastic and inelastic column behavior; Inelastic buckling; Column design formulas.

UNIT V

Energy methods

Introduction; Principal of virtual work; Unit-load method for calculating displacements; Reciprocal theorems; Strain-energy and complementary energy; Strain-energy methods; Complementary energy methods; Castigliano's second theorem; Shear deflections of beams.

TEXT BOOK

Mechanics of Materials *by* J.M.Gere and S.Timoshenko; *Publisher: CBS*

REFERENCE

Engineering Mechanics of Solids *by* E.P.Popov; *Publisher: Pearson Education.*

Strength of Materials *Schaum's Series.*

II Year B.Tech AE II sem	L	T/P/D	C
	4	1	4

(R11MED1111) KINEMATICS OF MACHINERY

KINEMATICS AND MECHANISMS

UNIT I

About mechanisms

Introduction; introduction to analysis and synthesis; The science of mechanics; Terminology, definitions, and assumptions; Introduction to planar, spherical, and spatial mechanisms; Mobility; Classification of mechanisms; Kinematic inversion; Grashof's law; Mechanical advantage.

Position and displacement

Locus of a moving point; Position of a point; Position difference between two points; Apparent position of a point; Absolute position of a point; Graphic position analysis; Algebraic position analysis; Complex-algebra solutions of planar vector equations; Overview of Complex polar algebra; Position analysis techniques.

UNIT II

Velocity

Definition of velocity, Rotation of a rigid body; Velocity difference between points of a rigid body; Graphic methods-velocity polygons; Apparent velocity of a point in a moving coordinate system; Apparent angular velocity; Direct contact and rolling contact; Systematic strategy for velocity analysis; Analytic methods; Overview of complex-algebra methods; The method of kinematic coefficients; The vector method; Instantaneous center of velocity; The aronhold-kennedy theorem of three centers; Locating instant centers of velocity; Velocity analysis using instant centers; Mechanical advantage; Centrodes.

Acceleration

Definition of acceleration; Angular acceleration; Acceleration difference between points of a rigid body; Acceleration polygons; Apparent angular acceleration; Direct contact and rolling contact; Systematic strategy for acceleration analysis; Analytic methods; Overview of Complex algebra methods; Overview of the method of kinematic coefficients.

DESIGN OF MECHANISMS

UNIT III

Cam design

Introduction; Classification of cams and followers; Displacement diagrams; Graphical layout of cam profiles; Kinematic coefficients of the follower motion; Overview of high speed cams; Standard cam motions; matching derivatives of the displacement diagrams; Plate cam with reciprocating flat-face follower; Plate cam with reciprocating roller follower.

UNIT IV

Spur gears

Terminology and definitions; Fundamental law of toothed gearing; Involute properties; Interchangeable gears; AGMA standards; Fundamentals of gear tooth action; The manufacture of gear teeth; Interference and undercutting; Contact ratio, Varying the center distance; Involutometry; Nonstandard gear teeth.

Helical gears

Parallel-axis helical gears; Helical-gear-tooth relations; Herringbone gears;

Bevel gears

Straight-tooth bevel gears.

Overview of worm gears.

UNIT V

Mechanism trains

Parallel-axis gear trains and definitions; Examples of gear trains; Determining tooth numbers; Epicyclic gear trains; Bevel-gear epicyclic trains; Analysis of planetary trains by formula; Tabular analysis of planetary gear trains; Overview of adders and differentials; All-wheel drive train.

TEXT BOOK

Theory of Machines and Mechanisms *by* J.J. Uicker Jr., G.R. Pennock, and J.E.Shigley; *Publisher: McGraw Hill.*

REFERENCE

1. Mechanism Design (Vol 1) by A.G.Erdman and G.N.Sandor; *Publisher: Prentice Hall of India.*
2. Theory of Machines by Thomas Bevan; *Publisher: CBS*
3. Design of Machinery by R.L.Norton; Publisher: *McGraw Hill*

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(R11AME1101) AUTOMOTIVE ENGINES

UNIT I

Introduction

Beginnings; Growth and Refinement; Modern Development; Overview

Thermodynamics of Prime Movers

Introduction; Two and Four StrokeEngines; Indicator Diagrams and Internal Combustion Engine PerformanceParameters; Otto and Diesel CycleAnalyses - The Ideal Air Standard OttoCycle, The Ideal Air Standard DieselCycle, and Efficiencies of RealEngines; Ignition and Combustion in Spark Ignition and Diesel Engines; Sources of Emissions - Simple CombustionEquilibrium, Unburned Hydrocarbons (HC) and Nitrogen Oxides (NOx) in Spark IgnitionEngines, Unbumed Hydrocarbons (HC), Nitrogen Oxides (NOx), and Particulates in Compression Ignition Engines; Fuel and AdditiveRequirements - Abnormal Combustion in Spark Ignition Engines, and Gasoline and DieselAdditives; Gas ExchangeProcesses - Valve Flow and Volumetric Efficiency, ValveTiming, Valve OperatingSystems, and Dynamic Behavior of ValveGear; EngineConfiguration - Choosing the Number ofCylinders, and Balancing of the Primary and Secondary Forces andMoments; FuelCells - Solid Polymer Fuel Cells(SPFC), Solid Polymer Fuel Cell (SPFC) Efficiency (activation Losses; fuel Crossover and Internal Currents; OhmicLosses; Mass TransferLosses; OverallResponse), and Sources of Hydrogen for Solid Polymer Fuel Cells (SPFC) (Steam Reforming(SR); Partial Oxidation (POX) Reforming; Autothermal Reforming(AR); Carbon Monoxide Clean-Up and Solid Polymer Fuel Cell (SPFC) Operation on Reformed Fuel; HydrogenStorage), and Hydrogen Fuel Cell Systems.

UNIT II

Spark Ignition Engines

Introduction; Engine parts – classification, function, and materials; Spark Ignition and Ignition Timing - Ignition System Overview, The IgnitionProcess, and Ignition Timing Selection and Control; Mixture Preparation; Combustion SystemDesign - Port Injection Combustion Systems, and Direct Injection Spark Ignition (DISI) Combustion Systems; Emissions Control - Development of the Three-Way Catalyst, Durability, Catalyst Light-Off, and Lean-Bum NOx-Reducing Catalysts, "DENOx"; Power Boosting - Variable Valve Timing and Induction Tuning, and Supercharging; Engine Management Systems – Introduction, and Sensor Types (Crankshaft Speed/Position and Camshaft Position; Throttle Position; Air Flow Rate; Inlet Manifold Absolute Pressure; Air Temperature and Coolant Temperature; Air-Fuel Ratio; Knock Detector); Engine Management System Functions – Ignition Timing, Air-Fuel Ratio Control, Exhaust Gas Recirculation (EGR) Control, and Additional Functions.

UNIT III

Diesel Engines

Introduction; Engine parts; Direct and Indirect Injection Combustion Chambers; Fuel Injection Equipment - Pump-Line-Injector (PLI) Systems, Electronic Unit Injectors (EUI), and Common Rail (CR) Fuel Injection Systems; Diesel Engine Emissions and Their Control - Diesel Engine Emissions, Diesel Engine Emissions Control (Exhaust Gas Recirculation (EGR); Particulate Traps); Turbocharging – Introduction, Turbocharger Performance, and Turbocharged Engine Performance; Diesel Engine Management Systems.

UNIT IV

Ancillaries

Introduction; Lubrication System – Bearings (Anti-Friction Bearings; Guide Bearings; Thrust Bearings; Journal Bearings), Engine Lubricants, and Lubrication of Journal Bearings; Vehicle Cooling Systems–Coolant; Drive Belts - Flat Belt Drives, and V-Belts); Air Conditioning Systems – Overview, Thermodynamic Performance and Operation, Coefficient of Performance (CoP), and Air Conditioning System Performance; Generators, Motors, and Alternators – Fundamentals, Practical Alternators, and Practical Starter Motors).

UNIT V

Overview of alternative vehicles

Case Study

Introduction; The Vauxhall – Introduction, Specifications, Engine Design and Performance, and Engine Performance.

TEXT BOOK

Automotive Engineering Fundamentals *by* Richard Stone and J.K. Ball; *Publisher: SAE International.*

REFERENCE

1. Automotive Mechanics *by* William H. Crouse and Donald L. Anglin; *Publisher: McGraw Hill* .
2. Automotive Mechanics by Heitner.
3. Automotive Mechanics by Kirpal Singh

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(R11MED1113) APPLIED THERMODYNAMICS

UNIT I

Steam cycles

Rankine cycle; Rankine cycle with superheat; The enthalpy-entropy chart; The reheat cycle; The regenerative cycle; Further considerations of plant efficiency; Steam for heating and process use.

Gas turbine cycles

The practical gas turbine cycle; Modifications to the basic cycle; Additional factors.

UNIT II

Nozzles and jet propulsion

Nozzle shape; Critical pressure ratio; Maximum mass flow; Nozzles off design pressure ratio, Nozzle efficiency; The steam nozzle; Stagnation conditions; Jet propulsion; The turbojet; The turboprop.

Positive displacement machines

Reciprocating compressors; Reciprocating compressors including clearance; Multi-stage compression; Steady-flow analysis; Rotary machines; Vacuum pumps; Air motors.

UNIT III

Rotodynamic machinery

Rotodynamic machines for steam and gas turbine plant; The impulse steam turbine; Pressure and velocity compounded impulse steam turbines; Axial-flow reaction turbines; Losses in turbines; Axial-flow compressors; Overall efficiency, stage efficiency, and reheat factor; Polytropic efficiency; Centrifugal compressors; Radial-flow turbines.

UNIT IV

Reciprocating internal-combustion engines

Four-stroke cycle; Two-stroke cycle; Other types of engine; Criteria of performance; Engine output and efficiency; Performance characteristics; Factors influencing performance; Real cycles and the air standard cycles; Properties of fuels for IC engines.

UNIT V

Reciprocating internal-combustion engines (contd)

Fuel systems; Measurement of air and fuel flow rates; Supercharging; Engine emissions and legal requirements; Alternative forms of IC engines; Developments in IC engines.

Overview of refrigeration and heat pumps

Psychrometry and air conditioning

Psychrometric mixtures; Specific humidity, relative humidity and percentage saturation; Specific enthalpy; Specific heat capacity; Specific volume of moist air; Overview of air-conditioning systems.

TEXT BOOK

Applied Thermodynamics *by* T.D.Eastop and A.McConkey; *Publisher: Addison Wesley*.

REFERENCE

1. Basic and Applied Thermodynamics *by* P.K.Nag; *Publisher: TMH.*
2. Engineering Fundamentals of IC Engine *by* Pulkrabek; *Publisher: Perason/PHI*.
3. Internal Combustion Engine Fundamentals *by* Heywood; *Publisher: McGraw Hill*.
4. I.C.Engines *by* V.Ganeshan; *Publisher: TMH.*

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(R11MED1114) PRODUCTION TECHNOLOGY

UNIT I

Materials in manufacturing

Major classes of engineering materials - metals, ceramics, plastics, composite structures, and joining.

Metal casting

Structure and properties of castings - solidification of melts, and macrosegregation;
Casting properties - viscosity, surface effects, and fluidity;
Casting alloys - ferrous materials, and non ferrous materials;
Melting and pouring: melting, pouring, and quality assurance;
Casting processes – classification, ingot casting, casting of shapes, expendable-mold and expendable-pattern casting, permanent-mold casting, and centrifugal casting;
Finishing processes - cleaning and finishing, and changing properties after casting;
Quality assurance – inspection, and casting defects;
Process capabilities and design aspects - process capabilities, and part design.

UNIT II

Plastic deformation of metals

Material properties - flow stress in cold working, discontinuous yielding, textures (anisotropy), effects of cold working, annealing, hot working, and interactions between deformation and structure;
Overview of Mechanics of deformation processing;
Wrought alloys - carbon steels, alloy steels, and nonferrous materials.

Bulk deformation process

Classification - temperature of deformation, purpose of deformation, and analysis;
Open die forging – axial upsetting of a cylinder, forging of rectangular workpieces, and open die forging;
Overview of Impression-die and closed-die forging;
Extrusion - the extrusion process, hot extrusion, cold extrusion, and extrusion force;
Forging and extrusion equipment - tools and dies, hammers, and presses;
Drawing: the drawing process, and overview of forces.
Rolling - flat rolling, shape rolling, ring rolling, transverse rolling, and overview of forces and power requirements.

UNIT III

Sheet metalworking processes

Sheet materials - steels, nonferrous materials, surface topography;
Classification;
Shearing - the shearing process, forces, improving the quality of cut, and processes;
Bending - the bending process, bending limits, stresses and springback, and bending methods;
Overview of Stretch forming;
Deep drawing - drawing processes, limiting draw ratio, and further drawing;

UNIT IV

Processing of plastics

Classification; Casting;
Melt processing (molding) - principles of melt processing, extrusion, injection moulding, other moulding techniques;
Processing in the rubbery state - blow moulding, thermoforming, cold drawing, matched-die forming;
Particulate processing techniques; Cellular or foam plastics; Processing of elastomers.

UNIT V

Joining processes

Classification; Mechanical joining;
Solid state welding - cold welding, diffusion welding, hot welding, and friction welding (FRW);
Fusion welding - the fusion joint, weldability and weld quality, and weldable materials;
Resistance welding;
Electric arc welding - nonconsumable electrode welding, consumable-electrode welding, and consumable-work piece welding;
Overview of liquid solid state bonding
Overview of Adhesive bonding;
Joining of plastics, and joining of ceramics.

TEXT BOOK

Introduction to Manufacturing Processes *by* John A. Schey; *Publisher: McGraw Hill*.

REFERENCE

1. Manufacturing Processes for Engineering Materials *by* Serope Kalpakjian
2. Manufacturing Technology (Volume 1) *by* P.N.Rao; *Publisher: TMH***.**
3. Process and Materials of Manufacturing by Lindberg; *Publisher: Pearson Education***.**

II Year B.Tech. AE II sem	L	T/P/D	C
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(R11EIE1130) Fundamentals of Electrical and Electronics Engineering

UNIT I

Introduction to electrical engineering

Basic circuit components, Types of elements, types of sources, Ohm's law, Kirchhoff's laws, Simple problems. resistive networks, inductive networks, capacitive networks, series, parallel circuits, star delta and delta star transformation, Network theorems- Super position, Thevenins's, Norton's, Maximum power transfer theorems and simple problems.

UNIT II

Alternating quantities

Principles of ac voltages, waveforms and basic definitions, root mean square and average values of alternating currents and voltages, form factor and peak factor, phasor representation of alternating quantities, the J operator and phasor algebra, analysis of ac circuits with single basic network element, single phase series circuits.

UNIT III

Diode: characteristics, rectifiers, and filters

Qualitative theory of p-n junction, p-n junction as a diode, diode equation, v-i characteristics, temperature dependence of VI characteristics, Ideal versus practical -resistance levels (static and dynamic), transition and diffusion capacitances, diode equivalent circuits, p-n junction as a rectifier , half wave, full wave and Bridge rectifiers. Filters **:** Inductor, Capacitor, L-section and π section filters. ripple factor. Need for voltage regulation.

UNIT IV

Bipolar junction transistor

Junction transistor, Transistor current components, transistor as an amplifier, Transistor Construction, BJT operation, BJT symbol, Configurations: Common Base, Common Emitter and Common Collector.

Biasing and Stabilization**:**

Operating point, Need for biasing, Fixed bias, collector-to-base bias, Voltage divider bias, Bias stability, Stabilization factors (S,S',S") definitions.

UNIT V

Field effect transistor

The junction FET (JFET), Construction and principle of operation, symbol, Pinch off voltage, Drain and Transfer characteristics, MOSFET principle of operation, symbol, MOSFET Characteristics in Enhancement and Depletion Modes.

TEXT BOOKS

1. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah; Publisher: TMH

2. Electronic Devices and Circuits by J.Millman and C.C.Halkias; *Publisher: Tata McGraw Hill, 1998.*

REFERENCE

1. Electronic Devices and Circuits by A.P. Godse and U.A.Bakshi, Technical Publications.
2. Electrical Circuit Theory and Technology – by John Bird; Publisher: Elsevier, 2007.
3. Theory and Problems of Basic Electrical Engineering by D.P.Kothari and I.J.Nagrath; *Publisher: PHI*.
4. Electrical Circuit Analysis-by Sudhakar and Shyam Mohan; *Publisher: TMH*

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(R11AME1201) AUTOMOTIVE ENGINES LAB I

(10 experiments)

PART-A

1. Study of Hand power and measuring tools – sketching, materials used and their uses.
2. Writing technical specification and descriptions of all types of automobile engines (petrol and diesel) –materials, functions with sketches.
3. (i) Dismantling, Inspection for wear and tear, crack, material breakdown of different engines components. Servicing of engines by paraffin and degreasing methods, decarborising procedure, Dismantling, Inspection and Assembly of different parts of two wheelers. 3 wheelers and 4 wheelers. Tractor and heavy duty engines covering 2–stroke and 4 stroke, SI and CI engines using the concepts of torque and assembly diagrams.

   (ii) Measurement of dimensions of different components of the above engines and compare the same with standard specifications. Assembling the engines with using special tools, necessary adjustments of the engine components. Value spring testing, connecting rod alignment, piston ring testing procedure for dismantling and assembling.

PART-B

1. Testing of I.C. Engines-Basic measurements –speed, fuel, flow, air ‘consumption, measurement of BHP using different types of dynamometers, their working principles. Determination of IHP, BHP. Mech. Efficiency, break thermal efficiency, indicated thermal efficiency, volumetric efficiency SFC. etc; Drawing head balance sheet for petrol and diesel engines.
2. Test on multi cylinder engines, Morse test.
3. Valve and port timing diagrams-determination of compression ratio.
4. Tests on Fuel and Lubricants.

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(R11MED1210) PRODUCTION TECHNOLOGY Lab

Metal casting lab

1. Pattern design and making - for one casting drawing.
2. Sand properties testing - exercise -for strengths, and permeability – 1
3. Moulding melting and casting - 1 exercise

Welding lab

1. ARC welding lap and butt joint - 2 exercises
2. Spot welding - 1 exercise
3. TIG welding - 1 exercise
4. Plasma welding and brazing - 2 exercises

Mechanical press working

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

Processing of plastics

1. Injection moulding
2. Blow moulding

Automotive body building

1. Fabrication of automotive body parts.
2. Joining processes for automotive body parts.
3. Assembly of automotive body parts.

III Year B.Tech AE I sem	L	T/P/D	C
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(R11MED1115) DYNAMICS OF MACHINERY

UNIT I

Static force analysis

Introduction; Applied and constraint forces; Free-body diagrams; Conditions for equilibrium; Two- and three- force members; Four-force members; Friction-force models; Static force analysis with friction; Spur-and helical-gear force analysis; Straight-bevel-gear force analysis; The method of virtual work.

UNIT II

Dynamic force analysis (Planar)

Introduction; Centroid and center of mass; Mass moments and products of inertia; Inertia forces and D' Alembert's principle; The principle of superposition; Planar rotation about a fixed center; Shaking forces and moments; Complex algebra approach; equation of motion.

Dynamic force analysis (Spatial)

Introduction; Measuring mass moment of inertia; Transformation of Inertia axes; Euler's equations of motion; Impulse and momentum; Angular impulse and angular momentum.

UNIT III

Dynamics of reciprocating engines

Engine types; Indicator diagrams; Dynamic analysis-general; Gas forces; Equivalent masses; Inertia forces; Bearing loads in a single-cylinder engine; Crankshaft torque; Engine shaking forces; Computation overview.

UNIT IV

Balancing

Static unbalance; Equations of motion; Static balancing machines; Dynamic unbalance; Analysis of unbalance; Dynamic balancing; Balancing machines; Field balancing with a programmable calculator; Balancing a single-cylinder engine; Balancing multicylinder engines; Analytical technique for balancing multicylinder reciprocating engines; Balancing linkages; Balancing of machines.

UNIT V

Overview of cam dynamics

Flywheels

Dynamic theory; Integration technique; Multicylinder engine torque summation.

Governors

Classification**;** Centrifugal governors; Inertia governors; Mechanical control systems; Standard input functions; Solution of linear differential equations; Analysis of proportional–error feedback systems.

Gyroscopes

Introduction; The motion of a gyroscope; Steady or regular precession; Forced procession.

TEXT BOOK

Theory of Machines and Mechanisms *by* J.J. Uicker Jr., G.R. Pennock, and J.E.Shigley; *Publisher: McGraw Hill.*

REFERENCE

1. Mechanism Design (Vol 1) by A.G.Erdman and G.N.Sandor; *Publisher: Prentice Hall of India.*
2. Theory of Machines by Thomas Bevan; *Publisher: CBS*
3. Design of Machinery by R.L.Norton; *Publisher: McGraw Hill*

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(R11MED1116) MECHANICAL ENGINEERING DESIGN I

FUNDAMENTALS OF MECHANICAL DESIGN

UNIT I

Introduction

The meaning of design; Mechanical engineering design; The phases of design; Recognition and identification; Evaluation and presentation; Design considerations; Factor of safety; Codes and standards; Economics; Reliability; Safety and product liability; Units.

Stress analysis

Stress; Mohr's circle; Triaxial stress states; Uniformly distributed stresses; Elastic strain; Stress strain relations; Shear and moment; Singularity functions.

Normal stresses in bending; Vector programming; Beams with unsymmetrical sections; Shear stresses in beams; Shear stresses in rectangular-section beams; Flexural shear for other shapes; Shear center; Torsion; Stresses in cylinders; Press and shrink fits;

Strain energy

Concepts, The theorem of Castigliano; Overview of columns;

UNIT II

Design for static strength

Static strength; Static loads and factor of safety; Failure theories; The maximum-normal-stress theory; The maximum-shear-stress theory; The distortion–energy theory; Failure of ductile materials; Failure of brittle materials; Stress concentration; Determination of stress concentration factors; Stress-concentration charts; Stress concentration and static loads.

Design for fatigue strength

Introduction; The S-N diagram, Low-cycle fatigue; High-cycle fatigue; Endurance-limit modifying factors; Surface finish; Size effects; Reliability; Temperature effects; Stress concentration effects; Fluctuating stresses; Fatigue strength under fluctuating stresses.

DESIGN OF MECHANICAL ELEMENTS

UNIT III

The design of screws, fasteners, and connections

Thread standard and definitions; The mechanics of power screws; Thread stresses; Threaded fasteners; Bolted joints in tension; Compression of bolted members; Torque requirements; Strength specifications; Bolt preload; Selecting the nut; Fatigue loading; Gasketed joints; Bolted and riveted joints loaded in shear; Centroids of bolt groups; Shear of bolts and rivets due to eccentric loading; Keys, pins, and retainers.

UNIT IV

Welded, brazed, and bonded joints

Welding; Butt and fillet welds; Torsion in welded joints; Bending in welded joints; The strength of welded joints.

Mechanical springs

Stresses in helical springs; Deflection of helical springs; Extension springs; Compression springs; Spring materials; Design of helical springs; Critical frequency of helical springs; Overview of Fatigue loading.

UNIT V

Rolling contact bearings

Bearing types; Bearing life; Bearing load; Selection of ball and straight roller bearings; Selection of tapered roller bearings; Lubrication; Mounting and enclosure.

TEXT BOOK

1. Mechanical Engineering Design (SI edition) *by* J.E. Shigley; *Publisher: McGraw Hill.*
2. Mechanical Engineering Design (SI edition) *by* J.E.Shigley and Mischke.
3. Mechanical Engineering Design (International edition) *by* J.E.Shigley, Mischke, and Budynas; *Publisher: McGraw Hill.*
4. Mechanical Engineering Design (International edition) *by* J.E.Shigley, Mischke, R.G.Budynas, and K.J.Nisbett; *Publisher: TMH.*

REFERENCE

1. Machine Design *by* R.L.Norton; *Publisher: McGraw Hill*.
2. *Schaum's Outline* of Machine Design; *Publisher: TMH*

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(R11MTH1104) NUMERICAL ANALYSIS AND LINEAR PROGRAMMING

NUMERICAL ANALYSIS

UNIT I

Solutions of nonlinear systems

Introduction; Mathematical preliminaries; Solution of algebraic and transcendental equations – the bisection method, the method of false position, the iteration 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; Lagrange and Hermite interpolation formulae; Cubic spline interpolation.

UNIT III

Numerical differentiation and Integration

Introduction; Differentiation of equally and unequally spaced data, and finite difference approximations; Trapezoidal rule, Simpson's 1/3 rule, and Simpson's 3/8 rule.

Numerical solutions of ordinary differential equations

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

UNIT IV

Numerical solutions of partial differential equations (PDE)

Introduction; Classification of second order PDE; finite difference approximations to derivatives; Solution of Laplace and Poisson equation - Jacobi's method, Gauss-Seidal method (by Leibmann's), Solution of parabolic equations (heat equation) by explicit and Crank Nicolson implicit scheme method; Solution of hyperbolic equations (wave equation).

LINEAR PROGRAMMING

UNIT V

Linear programming

Basic concepts; formulation of linear programming problem; constrained optimization-linear programming - simplex method, dual simplex method, and transportation problems.

TEXT BOOKS

1. Introduction to Numerical Analysis *by* S.S.Sastry;*, Publisher: PHI , 2010.*

2. Operations Research *by* Prem Kumar Gupta and D.S.Hira (2003); *Publisher: S.Chand.*

REFERENCE

1. Advanced Engineering Mathematics *by* Erwin Kreyszig, 8th Edition; *Publisher: John Wiley and Sons.*
2. Advanced Engineering Mathematics *by* Peter V. O'Neil, 9th Edition; *Publisher: Cengage Learning.*
3. Elementary Numerical Analysis: An algorithmic approach *by* Samuel D. Conte and Carl De Boor (2006); 3rd edition; *Publisher: Tata McGraw Hill.*
4. Numerical Analysis *by* R.L Burden and J.D Faires; 7th edition; *Publisher: Thomson, 2007.*

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(R11MED1117) MACHINE TOOLS

UNIT I

Introduction

Introduction to material removal processes; Variety of machine tools.

Metal cutting

Introduction; Chip formation; Shear zone; Orthogonal cutting; Shear angle and its relevance; Cutting tool materials; Thermal aspects; Tool wear and tool life; Surface finish; Cutting fluids; Empirical and analytical determination of cutting forces; Economics.

Machine tools

Introduction; Classification of machine tools; Generating and forming; Methods of generating surfaces; Accuracy and finish achievable; Basic elements of machine tools; Support structures; Power transmission; Actuation systems; Guideways; General work holding methods.

UNIT II

Centre lathe

Introduction; Constructional features of a centre lathe; Aids for support and location; Cutting tools; Operations performed in a centre lathe; Taper turning methods; Thread-cutting methods; Special attachments; Machining time and power estimation; Typical setups.

Special purpose lathes

Limitations of a centre lathe; Capstan and turret lathes; Automatic lathes; Tooling layout.

Reciprocating Machine Tools

Introduction; Shaper; Planing machine; Slotter.

UNIT III

Milling

Introduction; Types of milling machines; Milling cutters; Milling operations; Dividing head; Milling Mechanics; Milling time and power estimation; Special setups.

Hole-making operations

Introduction; Drilling; Reaming; Boring; Tapping; Other hole-making operations.

Abrasive processes

Introduction; Grinding wheel designation and selection; Types of grinding machines; Grinding process; Grinding process parameters; Creep feed grinding; Honing; Lapping; Other finishing processes.

UNIT IV

Other machine tools

Sawing; Overview of Broaching; Gear cutting.

Overview of Machine tool testing

Designing for machining

Introduction; General guidelines for “design for machining”.

UNIT V

Jigs and fixtures

Introduction; Functional surfaces; Location principles; Locating devices; Clamping devices; Jigs; Designing a Jig; Fixtures.

TEXT BOOK

Manufacturing Technology (Volume 2): Metal Cutting and Machine Tools *by* P.N. Rao; *Publisher: McGraw Hill.*

REFERENCE

1. Technology of Machine Tools *by* Steve F Krar, Arthur R Gill, and Peter Smid; *Publisher: McGraw Hill.*
2. Production Technology; *Publisher: HMT and McGraw Hill.*
3. Manufacturing Engineering and Technology by Serope Kalpakjian and Steven R. Schmid; *Publisher: Pearson.*

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(R11MED1118) METROLOGY AND INSTRUMENTATION

METROLOGY FOR WORKSHOP/ MACHINE SHOP

UNIT I

Accuracy – interchangeability – gauging

Conditions and synthesis of accuracy; Interchangeability and limit systems; BS system; Selective assembly gauging; Limit gauges; Indicating gauges; Special and first operation gauges.

Checking and measurement of surfaces

Surface relationships and accuracy; Tests for accuracy; Flatness; Squareness; Parallelism; Roundness; Concentricity; Angle measurement; Vernier protractor; Length measurement; The rule; Calipers; Micrometer; Vernier caliper; Use of gauges; Metric system; Metric and english micrometer and vernier.

UNIT II

Measurement and precision work

Slip gauges; Comparator; Vernier height guage; Marking out; Vernier micrometer; Examples of measurement; Sine bar; Angular testing; Use of rollers; Tapers; Projection.

Measurement and inspection

The standard of length; Measurement and comparison of length; Plane, angular, and linear examination; Comparison of heights and parallelism; Angular and division testing; The tool maker's microscope; Inspection and control on the machine.

Screw thread and spur gear measurement

Screw thread shapes and accuracy; Screw thread inspection; Screw thread limits and tolerances; Measurements and testing of gears.

UNIT III

Surface roughness measurements

Surface roughness vs. surface waviness; Numerical assessment of surface finish; Methods of measurements of surface finish; ISI symbols for indication of finish.

INSTRUMENTATION: MECHANICAL MEASUREMENTS

Measurement of flow

Introduction; Basic principles of flow measurement; Fluid flow in closed pipes; Flow in open channels; Point velocity measurement; Flow meter calibration methods.

Overview of measurement of viscosity

INSTRUMENTATION SYSTEMS

UNIT IV

Classification of instrument transducers

Primary quantities – input characteristics; Secondary quantities – output characteristics; Electromechanical coupling characteristics – electromechanical analogies, and Unified theory of bilateral electromechanical transducers (basic two port equations; ideal transducers; real transducers); Feedback systems.

Design and construction of instruments

Introduction; Instrument design; Elements of construction; Construction of electronic instruments; Mechanical instruments;

Instrument installation and commissioning

Introduction; General requirements; Storage and protection; Mounting and accessibility; Piping systems. Cabling; Earthing; Overview of testing and precommissioning; Plant commissioning.

UNIT V

Overview of pneumatic instrumentation

Display and recording

Introduction; Indicating devices; Light-emitting diodes (LEDs); Liquid crystal displays (LCDs); Plasma displays; Cathode ray tubes (CRTs); Graphical recorders; Magnetic recording; Transient/waveform recorders; Data loggers.

Interface and backplane bus standards for instrumentation systems

Introduction; Principles of interface; Data-link control protocol; Parallel interface and buses; Parallel bus; backplane bus; parallel bus; Black plane bus standards.

TEXT BOOK

For Metrology part:

1. Workshop Technology - Part I (3rd edition) by W.A.J. Chapman; pp. 194 to 228; *Publisher: Viva Books.*
2. Workshop Technology - Part II (3rd edition) by W.A.J. Chapman; pp. 1 to 68; *Publisher: Viva Books.*
3. Workshop Technology - Part III (3rd edition) by W.A.J. Chapman and S.J. Martin; pp. 481 to 506 and 531 to 545; *Publisher: Viva Books.*

For Instrumentation part:

INSTRUMENTATION *by* B.E. Noltingk (Part Numbers 1, and 4); *Publisher: Butterworth-Heinemann* 1995

(Alternatively available as separate books, Jones' Instrument Technology - Volume 1: Mechanical Measurements; Jones' Instrument Technology - Volume 4: Instrumentation Systems *by* Ernest Beachcroft Jones, and B.E.Noltingk; *Publisher: Butterworths* 1985/1987).

REFERENCE

1. Instrument Transducers: An Introduction to Theory *by* Neubert Herman; *Publisher: Oxford - Harper Collins*
2. Engineering Metrology by Hume
3. Metrology by R.K. Jain

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(R11CED1109) ENVIRONMENTAL STUDIES

UNIT I

Introduction; Definition, scope, and Importance

Ecosystems - Introduction, types, Classification of Eco system, AND structure and functions of ecosystems.

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 of Bio Diversity; Conservation of bio-diversity.

UNIT II

Natural Resources

Classification of Resources; Land resources; Land degradation; Soil erosion and desertification; Food resources; Effects of modern agriculture; Fertilizer pesticide problems; Food miles; Organic farming; Forest resources; Use and over-exploitation; Water resources; Dams–benefits; Conflicts over Water; Energy resources-sustainable Development; Energy Audit

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 and waste water treatment methods; Water quality standards; Noise pollution causes; Effects; Control measures; Land pollution causes, effects, and control measures; Solid waste disposal methods; Characteristics of e-waste and management.

UNIT IV

Global Environmental problems and global Efforts

Nuclear hazards; Global warming; Acid rain; Hurricanes; Hazardous Waste; Overpopulation; Ozone layer depletion; Clean development mechanism; Green computing; Green Building; Carbon credits; Carbon trading.

International conventions/protocols

Earth summit; Kyoto protocol and Montreal protocol; Stockholm Declaration

UNIT V

Environmental Impact Assessment and Environmental Management plan

Definition of impact; Classification of Impacts; Prediction of impacts and impact assessment methodologies; Environmental impact statement; Environmental management plan - Technological Solutions.

TEXT BOOKS

1. Introduction to Environmental Science *by* Y.Anjaneyulu; *Publisher: BS Publications.*
2. Text book of Environmental Studies *by* Deeksha Dave; *Publisher: Cengage Learning.*
3. Textbook of Environmental Science and Technology by M.Anji Reddy; *Publisher: BS Publications*

REFERENCE

1. Environmental Science *by* Anubha Kaushik and C P Kaushik; *Publisher: New Age International*
2. Environmental Studies *by* S V S Rana; *Publisher: Rastogi Publications*
3. Text book of Environmental Studies *by* Dr. K Raghavan Nambiar; *Publisher: Scitech Publishers*.

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

(R11MED1211) MACHINE TOOLS LAB

1. Introduction to general purpose machines - lathe, drilling machine, milling machine, shaper, planing machine, slotting machine, cylindrical grinder, surface grinder, and tool and cutter grinder.
2. Step turning and taper turning on lathe machine.
3. Thread cutting and knurling on lathe machine.
4. Drilling and tapping.
5. Shaping and planning.
6. Slotting.
7. Milling.
8. Cylindrical surface grinding.
9. Machining of engine components.
10. Machining of transmission components.

III Year B.Tech. AE I sem	L	T/P/D	C
	0	5	3

(R11MED1212) METROLOGY AND INSTRUMENTATION LAB

METROLOGY: Ten 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 Taly Surf.
11. Surface wear resistances test using electro spark coating device.

INSTRUMENTATION LAB: Ten experiments

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

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.*

III Year B.Tech AE II Sem	T	T/P/D	C
	4	1	4

(R11MED1120) MECHANICAL ENGINEERING DESIGN II

UNIT I

Lubrication and journal bearings

Types of lubrication; Viscosity; Petroff's law; Stable lubrication; Thick-film lubrication; Hydrodynamic theory; Design considerations; Bearing performance; Optimization techniques; Pressure–fed bearings; Heat balance; Bearing design; Bearing types; Thrust bearings; Bearing materials; Boundary- lubricated bearings.

UNIT II

Spur gears

Nomenclature; Conjugate action; Involute properties; Fundamentals; Contact ratio; Interference; The forming of gear teeth; Basic tooth dimensions; Gear trains; Force analysis; Tooth stresses; Dynamic effects; Estimating gear size; Fatigue strength; Factor of safety; Surface durability; Surface fatigue strength; Heat dissipation; Gear materials; Gear- blank design.

Helical, worm, and bevel gears

Parallel helical gears-kinematics; Helical gears-tooth proportions; Helical gears- force analysis; Helical gears-strength analysis; Crossed helical gears; Worm gearing–kinematics; Worm gearing-force analysis; An observation and some REFERENCE; Straight bevel gears- kinematics; Bevel gears- force analysis; Spiral bevel gears.

UNIT III

Shafts Power screws

Introduction; Design for static loads; A historical approach; Reversed bending and steady torsion; The Soderberg approach; The Goodman approach; A general approach; The Sines approach, Suggestions for computer solution.

Power Screws

UNIT IV

Clutches, brakes, couplings, and flywheels

Statics; Internal–expanding rim clutches and brakes; External–contracting rim clutches and brakes; Band-type clutches and brakes; Band type clutches and brakes; Frictional-contact axial clutches; Cone clutches and brakes; Energy considerations; Temperature rise; Friction materials; Miscellaneous clutches and couplings; Flywheels.

UNIT V

Flexible, mechanical elements

Belts; Flat- belt drives; V belts; Roller chain; Rope drives; Wire rope.

TEXT BOOK

1. Mechanical Engineering Design (SI edition) *by* J.E. Shigley; *Publisher: McGraw Hill.*
2. Mechanical Engineering Design (SI edition) *by* J.E.Shigley and Mischke.
3. Mechanical Engineering Design (International edition) *by* J.E.Shigley, Mischke, and Budynas; *Publisher: McGraw Hill.*
4. Mechanical Engineering Design (International edition) *by* J.E.Shigley, Mischke, R.G.Budynas, and K.J.Nisbett; *Publisher: TMH.*

REFERENCE

1. Machine Design by R.L.Norton; *Publisher: McGraw Hill*.
2. *Schaum's Outline* of Machine Design; *Publisher: TMH.*

III Year B.Tech AE II Sem	T	T/P/D	C
	4	1	4

(R11AME1102) STRUCTURAL ANALYSIS

UNIT I

Types of structures and loads

Introduction; Classification of structures; Loads; Structural Design.

Analysis of statically determinate structures

Idealized structures; Principle of superposition; Equations of equilibrium; Analysis of simple diaphragm and shear wall systems; Maximum influence at a point due to a series of concentrated loads.

UNIT II

Analysis of statically determinate trusses

Common types of trusses; Classification of coplanar trusses; The method of joints; Zero-force members; The method of sections; Compound trusses; Complex trusses; Space trusses.

UNIT III

Internal loading developed in structural members

Internal loading at a specified point; Shear and moment functions; Shear and moment diagrams for a beam; Shear and moment diagrams for a frame; Moment diagrams constructed by the method of superposition.

UNIT IV

Cables and Arches

Cables; cable subjected to concentrated loads; Cable subjected to a uniform distributed load; Arches; Three-hinged arch.

UNIT V

Influence lines for statically determinate structures

Influence lines; Influence lines for beams; Qualitative influence lines; Influence lines for floor girders; Influence lines for trusses; Live loads for bridges; Maximum influence at a point due to a series of concentrated loads; Absolute maximum shear and moment; Overview of applications for influence lines.

Deflections

Deflections of trusses by virtual work method

Overview of analysis of statically indeterminate structures

TEXT BOOK

Structural Analysis *by* R.C.Hibbeler; *Publisher: Pearson Education*

REFERENCE

Fundamentals of Structural Analysis by Kenneth M. Leet and Chia – Ming Uang; *TMH***.** Structural Analysis *by* Prakash Rao.

III Year B.Tech AE II Sem	T	T/P/D	C
	3	1	3

(R11AME1103) AUTOMOTIVE CHASSIS AND SUSPENSION

UNIT I

Types of suspension and drive

General characteristics of wheel suspension; Independent wheel suspensions (general) – Requirements, Double wishbone suspensions, McPherson struts and strut dampers, Rear axle trailing-arm suspension, Semi-trailing-arm rear axles, and Multi-link suspension; Rigid and semi-rigid crank axles - Rigid axles, and Semi rigid crank axles; Front-mounted engine, rear-mounted drive - Advantages and disadvantages of the front-mounted engine, rearmounted drive design, Non-driven front axles, and Driven rear axles; Rear and mid engine drive; Front-wheel drive - Types of design, Advantages and disadvantages of front-wheel drive, Driven front axles, and Non-driven rear axles;

UNIT II

Types of suspension and drive (contd)

Four-wheel drive - Advantages and disadvantages, Four-wheel drive vehicles with overdrive Manual selection four-wheel drive on commercial and all-terrain vehicles, Permanent four-wheel drive, basic passenger car with front-wheel drive, Permanent four-wheel drive, basic standard design passenger car, and Summary of different kinds of four-wheel drive;
Overview of Tyres and wheels;
Overview of wheel travel and elastokinematics;

UNIT III

Steering

Steering system – Requirements, Steering system on independent wheel suspensions, and Steering system on rigid axles; Rack and pinion steering - Advantages and disadvantages, Configurations, Steering gear, manual with side tie rod take-off, Steering gear, manual with centre tie rod take-off; Recirculating ball steering - Advantages and disadvantages, and Steering gear; Power steering systems - Hydraulic power steering systems, Electro-hydraulic power steering systems, and Electrical power steering systems; Steering column; Steering damper; Steering kinematics - Influence of type and position of the steering gear, Steering linkage configuration, Tie rod length and position

UNIT IV

Springing

Comfort requirements - Springing comfort, Running wheel comfort, and Preventing 'front-end shake'; Masses, vibration and spring rates; Weights and axle loads - Curb weight and vehicle mass, Permissible gross vehicle weight and
Mass, Permissible payload, Design weight, Permissible axle loads, and Load distribution according to IS0 2416; Springing curves - Front axle, Rear axle, Springing and cornering behavior, and Diagonal springing; Spring types - Air- and gas-filled spring devices, Steel

springs, Stops and supplementary springs, and Anti-roll bars; Shock absorbers (suspension dampers) - Types of fitting, Twin-tube shock absorbers, non-pressurized, Twin-tube shock absorbers, pressurized, Monotube dampers, pressurized, Monotube dampers, non-pressurized, Damping diagrams and characteristics, Damper attachments, and Stops and supplementary springs; Spring/damper units; McPherson struts and strut dampers - McPherson strut designs, Twin-tube McPherson struts, non-pressurized Twin-tube McPherson struts, pressurized, and Damper struts; Variable damping

UNIT V

Chassis and vehicle overall

Vehicle and body centre of gravity - Centre of gravity and handling Properties, Calculating the vehicle centre of Gravity, Axle weights and axle centres of Gravity, Body weight and body centre of Gravity; Mass moments of inertia;

Braking behavior – Braking, Braking stability, Calculating the pitch angle, Influence of radius-arm axes, Anti-dive control and brake reaction support angle; Traction behavior - Drive-off from rest, Climbing ability, and Skid points; Platform, unit assembly and common part systems

TEXTBOOK

The automotive chassis engineering principles by J. Reimpell, H. Stoll, J. W. Betzler;

Publisher: SAE International

REFERENCE

1. Automotive Chassis by P.M.Heldt; Publisher: Chilton
2. Automotive Chassis and Body by P.L.Kohli; Publisher: TMH

III Year B.Tech AE II sem	L	T/P/D	C
	3	1	3

(R11MED1122) HEAT AND MASS TRANSFER

UNIT I

Introduction

Conduction heat transfer; Thermal conductivity; Convection heat transfer; Radiation heat transfer; Dimensions and units.

Steady-state conduction – one dimension

Introduction; The plane wall; Insulation and *R* values; Radial systems; The overall heat–transfer coefficient; Critical thickness of insulation; Heat-source systems; Cylinder with heat sources; Conduction-convection systems; Fins; Thermal contact resistance.

UNIT II

Steady-state conduction

Introduction; Mathematical analysis of two-dimensional heat conduction; Graphical analysis; The conduction shape factor; Numerical method of analysis; Overview of Numerical formulation in terms of resistance elements.

Unsteady-state conduction

Introduction; Lumped-heat-capacity system; Transient heat flow in a semi-infinite solid; Convection boundary conditions; Transient numerical method; Overview of thermal resistance and capacity formulation.

UNIT III

Principles of convection

Introduction; Viscous flow; Inviscid flow; Laminar boundary layer on a flat plate; Energy equation of the boundary layer; The thermal boundary layer; The relation between fluid friction and heat transfer; Turbulent-boundary-layer heat transfer; Turbulent-boundary layer Thickness; Overview of heat transfer in laminar tube flow, turbulent flow in a tube, and heat transfer in high-speed flow.

Empirical and practical relations for forced convection heat transfer.

Natural convection systems

Introduction; Free-convection heat transfer on a vertical flat plate; Empirical relations for free convection; Free convection from vertical plates and cylinders; Free convection from horizontal cylinders; Free convection from horizontal plates; Free convection from inclined surfaces; Introduction to non-newtonian fluids.

UNIT IV

Radiation heat transfer

Introduction; Physical mechanism; Radiation properties; Radiation shape factor; Relations between shape factors; Heat exchange between nonblackbodies; Infinite parallel surfaces; Radiation shields; Gas radiation.

UNIT V

Condensation and boiling heat transfer

Introduction; Condensation heat-transfer phenomena; The condensation number; Film condensation inside horizontal tubes; Boiling heat transfer; Simplified relations for boiling heat transfer with water.

Heat exchangers

Introduction; The overall heat-transfer coefficient; Fouling factors; Types of heat exchangers; The log mean temperature difference; Effectiveness-NTU method, Overview of compact heat exchangers, and heat exchanger design considerations.

Mass transfer

Introduction; Fick's law of diffusion; Diffusion in gases; Diffusion in liquids and solids; The mass-transfer coefficient; Evaporation processes in the atmosphere.

TEXT BOOK

Heat Transfer *by* J.P. Holman; *Publisher: McGraw Hill.*

REFERENCES

1. Heat Transfer *by* P.K. Nag.
2. Heat and Mass Transfer by Cengel; *Publisher: McGraw Hill.*
3. Schaum's Outline of Heat Transfer; *Publisher; TMH*

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

(R11HAS1102) BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

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 economics 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.

UNI T 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 ratio, 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, 2009; *Publisher: Tata McGraw Hill*.
2. Managerial Economics *by* Varshney and Maheswari, 2009; *Publisher: Sultan Chand*.

REFERENCE

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

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

(R11MED1157) CAD/ CAM

OVERVIEW OF CAD/CAM SYSTEMS

UNIT I

CAD/CAM software

Introduction; Graphics standards; Basic definitions - data structure, database, database management system (DBMS), database coordinate system, working coordinate system, and screen coordinate system; Modes of graphics operations; User interface, Software modules - operating system (OS) module, graphics module, applications module, programming module, and communications module; Modeling and viewing; Software documentation; Software development; Efficient use of CAD/CAM software; Software trends.

GEOMETRIC MODELING

UNIT II

Types and mathematical representations of curves

Introduction; wireframe models; Wireframe entities; Curve representation; Parametric representation of analytic curves - review of vector algebra, lines, circles, ellipses, parabolas, hyperbolas, and conics; Parametric representation of synthetic curves - hermite cubic splines, Bezier curves, B-spline curves, and rational curves; Curve manipulations - displaying, evaluating points on curves, blending, segmentation, trimming, intersection, and transformation; Design and engineering applications; Graphics aids, graphics manipulations, and editings;

Practice of flow charts on the above topics to aid in the development of CAD software.

UNIT III

Graphics aids

Graphics aids, graphics manipulations, and editings

Overview of Types and mathematical representations of surfaces

Overview of Types and mathematical representations of solids

Overview of CAD/CAM data exchange

COMPUTER AIDED MANUFACTURING

UNIT IV

Part programming and manufacturing

Introduction; Part production cycle; Manufacturing systems; Manufacturing processes - removing processes, forming processes, deforming processes, and joining processes; Integration requirements; Process planning - manual approach, variant approach, generative approach, hybrid approach, and geometric modeling for process planning; Part programming - fundamentals of NC, Basics of NC programming , and NC programming languages; Overview of tool

path generation and verification.

UNIT V

Computer aided quality control

Introduction; Contact inspection methods; Noncontact inspection methods - machine vision, scanning laser beam devices and photogrammetry; Overview of Nonoptical-Noncontact inspection methods.

Computer aided manufacturing

Computer assisted process planning (CAPP); Group technology - methodology, steps required for the execution of group technology, and group technology concepts; Computer aided production management system (CAPMS); Materials requirement planning (MRP)- master production schedule; Shop floor control system – shop floor control, and functions of shop floor control; Overview of computer assisted production scheduling; Overview of flexible manufacturing system; Overview of parts based manufacturing information system.

TEXT BOOK

CAD/ CAM – THEORY and PRACTICE *by* Ibrahim Zeid; *Publisher: McGraw Hill*.

REFERENCE

1. CAD/ CAM *by* Zimmer and Groover; *Publisher: Pearson Education.*
2. Computer Graphics *by* Harrington; *Publisher: McGraw Hill*.

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

(R11AME1202) AUTOMOTIVE ENGINES LAB II

1. Dismantling and assembly of LMV components as following:

a. Gear box b) clutch assembly c) Propeller shaft d) differential gear box e) rear axle f) suspension system g) steering mechanism

2. Dismantling and assembly of door frames, door locks and window locks

3. study of driver's seat layout in anyone LMV and anyone HMV.

4. Testing, servicing and charging of batteries.

5. Servicing of generator, alternator and starter motor with dismantling, testing, inspection and assembly.

6. Servicing of ignition systems

7. Drawing of general electrical wiring diagrams of various vehicles {two and four wheelers}

8. Calibration of micrometer, measurement of plain plug, measurement of plain ring gauge, taper gauge

9. Measurement of taper using sine bar and other instruments.

10. Measurement of base circle diameter and tooth thickness of spur and helical gears

11. Use of slip gauges, measurement of screw thread using screw thread micrometer, use of comparators, experiments involving profile projectors.

Note: Driving practice of a geared two wheeler and anyone LMV for a minimum of 10 hours during 5 th and 6th semester must be provided.

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

(R11MED1213) HEAT AND MASS TRANSFER LAB AND ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LABORATORY

HEAT AND MASS TRANSFER LAB: Six experiments

1. Composite slab apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat transfer through a concentric sphere
4. Thermal conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on transient heat conduction
7. Heat transfer in forced convection : apparatus.
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan boltzman apparatus.
12. Heat transfer in drop and film wise condensation.
13. Critical Heat flux apparatus.
14. Study of heat pipe and its demonstration.
15. Study of Two – Phase flow.

ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LABORATORY

Introduction

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

The objectives of this course are to

i) expose students to workplace writing
ii) initiate them into the Process of Technical Communication
iii) to enable the students to create clear, accurate, and succinct content

iv) enable students to produce documents reflecting different types of technical communication such as Abstracts, Proposals and Technical Reports through ample practice
v) enable students to adjust technical content to meet the needs of a specific target audience
vi) groom students in behavioral skills

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.

Oral Communication Component

The objective of including Oral Communication is to impart behavioral skills and prepare students to speak to a large group or team, keeping in mind the audience, context and purpose of communication. This Oral Communication component must enable students to speak in an organized and mature way, without any inhibitions. They will be groomed to relate their speech to their audience.

Objectives of Oral Communication Component

i) equip students with Behavioral skills
ii) prepare them for Oral presentations, and Group Discussions
iii) equip them with Interview skills

Syllabus Outline

UNIT I

1. Applications and Covering letters
2. Resume Writing
3. Oral Communication :Self Introduction

UNIT II

1. Introduction to Technical Writing

- Defining Technical Writing
- Distinguishing it from other types of writing
- Determining audience, purpose and context

2. Summarizing and Synthesizing Information

3. Behavioral Skills and Personality Development

(a) Building a positive attitude, building a positive personality, Motivation, goal setting, values and vision

(b) Problem Solving and Decision Making; Negotiation Skills through Role Play

(c) Team Building and Leadership Abilities

UNIT III

1. Verbal Ability : language, reasoning skills, analytical ability, reading and listening skills
2. Oral Communication: Presentation Skills (Oral and Visual)

UNIT IV

1. Writing Research Abstracts
2. Oral Communication: Group Discussions

UNIT V

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

REQUIRED TEXT BOOKS AND MATERIALS

1. Technical Writing: Process and Product *by* Sharon J. Gerson and Steven M. Gerson (1999); *Publisher: Prentice Hall.*
2. Effective Technical Communication *by* Ashraf Rizvi, M., (2005); Publisher: *Tata Mc Graw Hill*.
3. Anderson, Paul V. (2003). Reports. In Paul V. Anderson's Technical Communication: A Reader-Centered Approach (5th ed.) (pp. 457-473). Boston: Heinle.

REFERENCE

1. Technical Communication *by* Rebecca E. Burnett, 5th edition (2001); *Publisher: Thomson/Wadsworth*
2. Technical Communication: A Practical Approach (7th ed.) *by* William S. Pfeiffer; *Publisher: Person education*
3. Technical Communication: Situations and Strategies *by* Mike Markel (2006-2007); *Publisher: Bedford/ St. Martins*.
4. Anderson, Paul V. (2003). Three Types of Special Reports. In Paul V. Anderson's Technical Communication: A Reader-Centered Approach (5th ed..) (pp. 474-513). Boston:Heinle.
5. Bolter, Jay David (2001), "The Late Age of Print" in Robert P. Yagelski's Literacies and Technologies: A Reader for Contemporary Writers (135-145); *Publisher: Longman*.

6. Brandt, Deborah. (1998) Sponsors of literacy. College Composition and Communication 49.2, 165-185.
7. Burnett, Rebecca, E. (2001) "Locating and Recording Information" in Rebecca E. Burnett's Technical Communication (pp. 164-195).
8. Johnson-Sheehan, Richard (2007). "Starting Your Career" in Richard Johnson-Sheehan's Technical Communication Today (2nd ed.) (pp. 388-402). New York: Longman.
9. Business Correspondence and Report Writing by R. C. Sharma and K. Mohan, Third Edition (2002); *Publisher: Tata McGraw Hill*.
10. Technical Communication: Principles and Practices by M. Raman and S. Sharma (Indian edition; 2004); *Publisher: Oxford University Press*.

IV Year B.Tech ME I SEM	L	T/P/D	C
	4	0	4

(R11HAS1103) MANAGEMENT SCIENCE

UNIT I

Introduction to management

Concepts of management - nature, importance, and functions of management; Taylor's scientific management theory; Fayol's principles of management; Mayo's Hawthorne experiments; Maslow's theory of human needs; Douglas McGregor's theory X and theory Y; Herzberg's two-factor theory of motivation; System and contingency approach to management; Planning – meaning, significance, and types of plans; Decision making and steps in decision making process; Leadership styles; Social responsibilities of management.

Organizing - Meaning, and features; Process of organization; Principles of organization; Elements of organization; Organization chart; Span of control - Graicunas formulae; Centralisation and decentralization; Types of mechanistic and organic structures of organisation - line organization, line and staff organization, functional organization, committee organization, matrix organization, virtual organisation, cellular organisation, team structure, boundaryless organization, inverted pyramid structure, and lean and flat organization structure; Their merits, demerits and suitability.

UNIT II

Human resources management

Concepts of HRM;

Basic functions of HR manager - human resource planning (definition; objectives; process), recruitment (definition; sources; techniques), selection (definition; process), induction and orientation, training and development (definition; need; methods), employee exit process, employee relations management, employee compensation and benefits administration, job evaluation (objectives; process; methods), and performance appraisals (objectives; process; methods).

UNIT III

Strategic management

Mission; Goals; Objectives; Policy; Strategy; Programmes; Elements of corporate planning process - environmental scanning; value chain analysis, BCG matrix, generic strategy alternatives, SWOT analysis, and steps in strategy formulation and implementation; Balance score card; Capability maturity model (CMM)/ People capability maturity model (PCMM).

UNIT IV

Operations management

Plant location; Types of plant layout; Methods of production – job, batch, and mass production; Work study-basic procedure involved in method study and work measurement.

Materials management

Objectives; Need for inventory control; EOQ, ABC Analysis; Purchase procedure; Value analysis; JIT, Six sigma; TQM; Supply chain management; Stores management and stores records.

Marketing

Functions of marketing; Marketing mix, and marketing strategies based on product life cycle; Channels of distribution.

UNIT V

Project management – network analysis

Network analysis; Programme evaluation review technique - PERT (probability of completing the project within given time); Critical path method - CPM (Identifying critical path); Project cost analysis; Project crashing; Simple problems.

TEXT BOOKS

1. Management Science *by* Aryasri; *Publisher: Tata McGraw Hill, 2009.*
2. Management *by* James Arthur, Finch Stoner, R. Edward Freeman, and Daniel R. Gilbert 6th Ed; *Publisher: Pearson Education/ Prentice Hall.*
3. Principles and Practice of Management - L.M. Prasad; *Publisher: Sultan Chand Publications, New Delhi.*

REFERENCE

1. Principles of Marketing: A South Asian Perspective *by* Kotler Philip, Gary Armstrong, Prafulla Y. Agnihotri, and Eshan ul Haque , 2010, 13th Edition, *Publisher: Pearson Education/ Prentice Hall of India*.
2. A Handbook of Human Resource Management Practice *by* Michael Armstrong, 2010; *Publisher: Kogan Page Publishers*.
3. Quantitative Techniques in Management *by* N.D. Vohra, 4th edition, 2010; *Publisher: Tata McGraw Hill*.
4. Operations Management: Theory and Practice *by* B. Mahadevan, 2010; *Publisher: Pearson Education*.
5. Strategic Management *by* V.S.P.Rao and V.Hari Krishna, 2010; *Publisher: Excel Books*.

VI Year B.Tech AE I Sem	T	T/P/D	C
Elective I	4	0	4

(R11AME1104) ALTERNATIVE FUELS FOR AUTOMOBILES

UNIT I

An Overview

Introduction-classification of alternative fuels and drive trains-scenario of conventional auto fuels-oil reserves of the world-fuel quality aspects related to emissions –technological up gradations required Need for alternative fuels –regulatory frame work for CNG/LPg vehicles in India- Third – party inspection check list for alternative fuels vehicles-comparsion of alternative fuel technologies – business driving factors for alternative fuels –implementation barriers for alternative fuels –Stakeholders of alternative fuels –
Road map for alternative fuels-AFV development world wide.

UNIT II

Compressed Natural Gas (CNG)

Introduction-History of CNG-Production of CNG-Properties of CNG-CNG storage –piping for CNG-Advantages and Disadvantages of CNG-CNG dispensing systems-CNG transportation-Material compatibility for CNG-CNG fuel kits-Engine modifications for CNG operations- CNG combustion-stoichiometric vs. Lean burn CNG engines-Engine optimization- vehicle emission from CNG – after treatment of CNG exhaust – CNG fuelling station safety systems- CNG standards and regulations- Third party inspection for alternative fuels vehicles. CNG vehicles wide – CNG scenario in India.

UNIT III

Liquefied Natural Gas (LNG)

Introduction-history LNG-Production of LNG-properties-economics of LNG-Advantages and Disadvantages- transportation and storage of LNG-piping for LNG- LNG dispensers- LNG to CNG conversion system-regulations for LNG- LNG vehicle world wide vehicle performance characteristics for LNG- vehicle emissions from LNG- LNG India.

Liquefied petroleum Natural Gas (LPG)

Introduction – History of LPG- Production of LPG- properties, Storage of LPG- Dispensing of LPG- LPG nozzles and receptacles- material compatibility for LPG- Piping, safety systems and transportation of LPG- Advantages and disadvantages of LPG- LPG engine developments- LPG fuel kits and combustion, Emission from LPG- LPG Standards– LPG vehicle world wide– LPG scenario in India

UNIT IV

Liquefied Hydrogen

Properties of Hydrogen- Production of hydrogen- photochemical production of Hydrogen-Algal production of Hydrogen (Bio Hydrogen)-On- board storage of Hydrogen-metal hydrates -compressed hydrogen gas-activates carbon storage- Hazards with LH_2– Advantages and disadvantages of LH_2– vehicle emissions from LH_2– BMW liquid hydrogen cars – liquid hydrogen in India.

Bio-Fuels

Bio gas-Methanol- Ethanol-Butanol-straight vegerable oil bio diesels - properties production – storage methods power densities advantages and disadvantages over conventional fuels – specific deign criteria use in automobiles.

UNIT V

Electric vehicles

Introduction- batteries electric vehicle-components of EV- EV batteries- EV charges- EV drives – EV tractive force EV transmission EV motor desing – EV Power devices and controllers-Advantages and Disadvantages –performance characteristics-testing

Fuel cell power vehicles

Fuel cell vehicle-Benefits of fuel cells for automotive industry- Basics, efficiency and types of fuel cells-Fuel cell options for fuel cell vehicle-fuel reguLations- Fuel cell hybrid vehicle- Fuel cell solar vehicle, Solar photovoltaic cell, Solar car electrical system and drive train, solar array-solar car body and chassis, Hybrid gas turbine EV, Nuclear car-road map for alternative power trains.

TEXT BOOKS

1. Alternative fuels/SS Thipse/JAICO publishers/2010
2. Alternative fuel technology/Erjavec,Arias/Yesdee publications/2009

REFERENCES

1. A Text Book of Alternative Fuel of Automobile Engine, Ramireddy and Yousuf, Front line publishers
2. The complete Idiot's Guide to Hybrid and Alternative Fuel Vehicles by Jack R.Nerad.
3. Hybrid and Alternative Fuel Vehicles (New Edition) by James D. Halderman
4. Powering your vehicle with straight vegetable Oil by Forest Gregg.

IV Year B.Tech. AE I SEM	L	T/P/D	C
Elective I	4	0	4

(R11AME1105) VEHICLE DYNAMICS

UNIT I

Introduction

General issues in vehicle dynamics; Vehicle system classification; Dynamic system; Classification of dynamic system models; Constraints, generalized coordinates, and degrees of freedom; Discrete and continuous systems; Vibration analysis;

Elements of vibrating systems - spring elements, potential energy of linear springs, equivalent springs (springs in parallel; springs in series), mass or inertia elements and damping elements (viscous damping; coulomb damping; structural or hysteretic damping; combination of damping elements);

Review of dynamics - Newton's laws of motion, kinematics of rigid bodies, linear momentum, principle of conservation of linear momentum, angular momentum, equations of motion for a rigid body, angular momentum of a rigid body, principle of work and energy, conservation of energy; principle of impulse and momentum, mechanical systems, translational systems, rotational systems, translation and rotational systems, angular momentum and moments of inertia, and geared systems;

Lagrange's equation - degrees of freedom, generalized coordinates, overview of virtual work, D'Alembert's principle, generalized force, Lagrange's equations of motion, Holonomic systems, Nonholonomic systems, and Rayleigh's dissipation function.

UNIT II

Analysis of Dynamic Systems

Introduction; Classification of Vibrations;

Classification of Deterministic Data - sinusoidal periodic data, complex periodic data, almost periodic data, and transient nonperiodic data;

Linear Dynamic Systems - linear single-degree-of-freedom system, free vibration of a single-degree-of-freedom system, forced vibration of a single-degree-of-freedom system, linear multiple-degrees-of-freedom system, eigenvalues and eigenvectors (undamped and damped systems), and forced vibration solution of a multiple-degreesof-freedom system;

Nonlinear Dynamic Systems - exact methods for nonlinear systems, approximate methods for nonlinear systems (iterative method, ritz averaging method, perturbation method, and variation of parameter method);

Graphical Method - phase plane representation, phase velocity, and pell's method and multiple-degrees-of-freedom systems;

Random Vibrations - probability density function, and autocorrelation function;

Gaussian Random Process - Fourier analysis (Fourier series; Fourier integral), response of a single-degree-of-freedom vibrating system (impulse response method; frequency response method), power spectral density function, joint probability density function, cross-correlation function, application of power spectral densities to vehicle dynamics, response of a single-degree-of-freedom system to random inputs, and response of multiple-degrees-of-freedom systems to random inputs;

UNIT III

Tire dynamics

Introduction; Vertical dynamics of tires - vertical stiffness and damping characteristics of tires, vertical vibration mechanics models of tires (point contact model of tires; fixed contact patch model of tires; time-varying contact patch model of tires), and enveloping characteristics of tires;

Tire longitudinal dynamics - tire rolling resistance, rolling resistance of the tire with toe-in, rolling resistance of the turning wheel, longitudinal adhesion coefficient, and theoretical model of tire longitudinal force under driving and braking;

Tire lateral dynamics - tire cornering characteristics, mathematical model of the tire cornering characteristic (simplified mathematical model of the tire cornering characteristic; cornering characteristic with lateral bending deformation of the tire case), and rolling properties of tires (cambered tire models; cambered tire model with roll elasticdeformation of the tire carcass);

Tire mechanics model considering longitudinal slip and cornering characteristics - C.G. Gim theoretical model, K.H. Guo tire model (steady-state simplified theoretical tire model; nonsteady-state semi-empirical tire mechanics model), and H.B. Pacejka magic formula model.

UNIT IV

Ride dynamics

Introduction;

Vibration environment in road vehicles - vibration sources from the road (power spectral density in spatial frequency; power spectral density in temporal frequency), vehicle internal vibration sources (vibration sources from the powerplant; vibration sources from the driveline; vibration sources from the exhaust system;

Vehicle ride models - quarter car model (modeling for the quarter car model; modal analysis for the quarter car model; dynamic analysis for the quarter car model), bounce-pitch model, and other modeling;

Seat evaluation and modeling – introduction, seat value, seat velocity, linear seat modeling and transmissibility, and nonlinear seat modeling and transmissibility.

UNIT V

(Contd) Ride dynamics

Discomfort evaluation and human body model - discomfort and subjective evaluation, objective evaluation of ride discomfort (weighted root-mean-square method, objective evaluation by the vibration dose value), linear human body modeling, objective evaluation by nonlinear seat-human body modeling;

Active and semi-active control – introduction, basic control concepts, active control, and semi-active control.

TEXT BOOK

Road Vehicle Dynamics *by* Rao Dukkipati, Jian Pang, Mohamad Qatu, Gang Sheng, and Shuguang Zuo; *Publisher: SAE International.*

REFERENCE

Mechanics of Pneumatic Tyre by S.K.Clark; Publisher: Prentice Hall

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Elective I	4	0	4

(R11MED1124) AUTOMATION IN MANUFACTURING

UNIT I

Introduction

Production systems; Automation in production systems; Manual labor in production systems; Automation principles and strategies.

Manufacturing operations

Manufacturing industries and products; Manufacturing operations; Product facilities; Product/production relationships; Lean production.

Manufacturing models and metrics

Mathematical models of production performance; Manufacturing costs.

AUTOMATION AND CONTROL TECHNOLOGIES

UNIT II

Introduction to automation

Basic elements of an automated system; Advanced automation functions; Levels of automation.

Industrial control systems

Process industries versus discrete manufacturing industries; Continuous versus discrete control; Computer process control.

Hardware components for automation and process control

Sensors; Actuators; Analog-to-digital converters; Digital-to-Analog converters; Input / Output devices for discrete data.

MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES

UNIT III

Material transport systems

Introduction to material handling equipment; Material transport equipment; Analysis of material transport systems.

Storage systems

Storage system performance and storage location strategies; Conventional storage methods and equipment; Automated storage systems; Engineering analysis of storage systems.

Automatic identification and data capture

Overview of automatic identification methods; Bar code technology; Radio frequency identification; Other AIDC Technologies

MANUFACTURING SYSTEMS

UNIT IV

Introduction to manufacturing systems

Components of a manufacturing system; Classification of manufacturing systems; Overview of the classification scheme;

Single-station manufacturing cells

Single station manned workstations; Single station automated cells; Applications single station cells; Analysis of single station cells.

Manual assembly lines

Fundamentals of manual assembly lines; Analysis of single model assembly lines; Line balancing algorithms; Mixed model assembly lines; Workstation considerations.

Other considerations in assembly line design

Alternative assembly systems.

UNIT V

Automated production lines

Fundamentals of automated production lines; Applications of automated production lines; Analysis of transfer lines.

Automated assembly systems

Fundamentals of automated assembly systems; Quantitative analysis of assembly systems.

TEXT BOOK

Automation, Production Systems and Computer-Integrated Manufacturing *by* Mikell P. Groover; *Publisher: Pearson/ Prentice Hall*.

REFERENCE

1. Computer Aided Manufacturing by Tien-Chien Chang, Richard A.Wysk and Hsu-Pin Wang; *Publisher: Pearson Education.*
2. Automation *by* W.Buekinsham.

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Elective I	4	0	4

(R11MED1126) ADVANCED MECHANISM DESIGN

UNIT I

Introduction to kinematics and mechanisms

Introduction; Motion; The four-bar linkage; The science of relative motion; Kinematic diagrams; Six-bar chains; Degrees of freedom; Analysis versus synthesis.

UNIT II

Introduction to kinematic synthesis: graphical and linear analytical methods

Introduction; Tasks of kinematic synthesis; Number synthesis - the associated linkage concept; Tools of dimensional synthesis; Graphical synthesis-motion generation - two prescribed positions; Graphical synthesis - motion generation - three prescribed positions; Graphical synthesis for path generation - three prescribed positions; Path generation with prescribed timing - three prescribed positions.

UNIT III

(Contd…) **Introduction to kinematic synthesis: graphical and linear analytical methods**

Graphical synthesis for path generation (without prescribed timing) - four positions; Function generator - three precision points; The overlay method; Analytical synthesis techniques; Complex number modeling in kinematic synthesis; The dyad or standard form; Number of prescribed positions versus number of free choices; Three prescribed positions for motion, path and function generation.

UNIT IV

(Contd…) **Introduction to kinematic synthesis: graphical and linear analytical methods**

Three–precision-point synthesis program for four–bar linkages; Three–precision-point synthesis - analytical versus graphical; Extension of three-precision-point synthesis to multiloop mechanisms; Circle-point and center–point circles; Ground-pivot specification; Freudenstein's equation for three-point function generation; Loop-closure-equation technique; Order synthesis - four-bar function generation.

UNIT V

Kinematic synthesis of linkages - advanced topics

Introduction; Motion generation with four prescribed positions; Solution procedure for four prescribed positions; Computer program for four prescribed precision points; Four prescribed motion-generation positions - superposition of two three-precision-point cases; Special cases of four-position synthesis; Motion generation - five positions; Solution procedure for five prescribed positions.

TEXT BOOK

Advanced Mechanism Design: Analysis and Synthesis (Volume 2) *by* George N. Sandor and Arthur G. Erdman; *Publisher: Prentice Hall of India.*

REFERENCE

1. Machines and Mechanisms *by* Pennock, Uickker, and Shigley
2. Design of Machinery *by* R.L.Norton

IV Year B.Tech AE I SEM	L	T/P/D	C
Elective II	4	0	4

(R11MED1128) THEORY OF ELASTICITY AND PLASTICTY

UNIT I

Introduction

Elasticity; Stress; Notation for forces and stresses; Components of stress; Components of strain; Hooke's law; Index notation; Plane stress; Plane strain; Stress at a point; Strain at a point; Measurement of surface strains; Construction of Mohr strain circle for strain rosette; Differential equations of equilibrium; Boundary conditions; Compatibility equations; Stress functions.

UNIT II

Two-dimensional problems in rectangular coordinates

Solution by polynomials; End effects; Saint–Venant's principle; Determination of displacements; Bending of a cantilever loaded at the end; Bending of a beam by uniform load, Other cases of continuously loaded beams; Solution of the two dimensional problems in the form of a Fourier series; Other applications of Fourier series - Gravity loading; End effects - Eigen solutions.

UNIT III

Two dimensional problems in polar coordinates

General equations in polar coordinates; Stress distribution symmetrical about an axis; Pure bending of curved bars; Strain components in polar coordinates; Displacements for symmetrical stress distributions; Rotating disks; Bending of a curved bar by a force at the end; Edge dislocation; The effect of circular holes on stress distributions in plates.

UNIT IV

(contd) Two dimensional problems in polar coordinates

Concentrated force at a point of a straight boundary; Any vertical loading of a straight boundary; Force acting on the end of a wedge; Bending couple acting on the end of a wedge, Concentrated force acting on a beam; Stresses in a circular disk; Force at a point of an infinite plate; Generalized solution of the two-dimensional problem in polar coordinates; Applications of the generalized solution in polar coordinates; A wedge loaded along the faces; Eigen solutions for wedges and notches.

UNIT V

Equations of plastic state

On the mechanical properties of solids - change in density and change in shape of a solid, elastic and plastic deformation, strain hardening, strain anisotropy, effect of strain rate, and creep; On the experimental study of plastic deformations under combined stresses - simple and complex loading – on experiments, and simple and complex loading; On yield conditions - yield surface and yield curve; The constant maximum shearing stress condition (Tresca-Saint Venant condition); The constant shearing stress intensity condition (Von

Mises condition); On strain hardening conditions - loading surface - loading and unloading, loading surface, and unloading; Conditions of isotropic strain hardening - simple variant of the condition of isotropic strain hardening, “unique curve” hypothesis, energy condition of strain hardening, and Odquist’s condition; Theory of plastic flow.

TEXT BOOK

For elasticity part:

Theory of Elasticity *by* S.P. Timoshenko and J.N. Goodier; *Publisher: McGraw Hill*.

For plasticity part:

Fundamentals of Theory of Plasticity by L.M.Kachanov; *Publisher: Mir Publisher.*

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Elective II	4	0	4

(R11MED1129) ROBOTICS

UNIT I

Introduction

Brief history; Types of robots; Technology of robots; Basic principles in robotics; Notation; Symbolic computation and numerical analysis.

Mathematical representation of robots

Introduction; Position and orientation of a rigid body – some properties of rotation matrices, successive rotations of a rigid body, representation of orientation by three angles, and other representations of orientation; Transformation between coordinate systems-homogeneous transformation; properties of ${}^{B}A[T]$; Representation of joints-rotary joint, prismatic joint, screw joint, cylindrical joint, spherical joint, spherical-spherical joint pair, and other joints; Representation of links using Denavit-Hartenberg – link parameters for intermediate links, and first and last links; Link transformation matrices-applications-the planar 3R manipulator, the puma 560 manipulator, and a scara manipulator, the planar four-bar mechanism, a three-DOF parallel manipulator; Homogeneous coordinates, lines, screws and twists.

UNIT II

Kinematics of serial manipulators

Introduction; Degrees of freedom of a manipulator; Direct kinematics of serial manipulators - the planar 3R manipulator, the PUMA 560 manipulator; and a SCARA manipulator; Inverse kinematics of serial manipulators - the planar 3R manipulator, and the PUMA 560 manipulator; Manipulator with non-intersecting wrist; Inverse kinematics of a general 6R robot; Inverse kinematics for manipulators with $n<6$; Inverse kinematics of redundant manipulators; Solution methods for non-linear equations.

UNIT III

Kinematics of parallel manipulators

Introduction; Degrees of freedom; Loop-closure constraint equations; Direct kinematics of parallel manipulators - the planar four-bar mechanism, a three-DOF parallel manipulator, and a six-DOF parallel manipulator; Direct kinematics of Stewart-Gough platform; Mobility of parallel manipulators - the planar four-bar mechanism, and a three-DOF parallel manipulator; Inverse kinematics of parallel manipulators - a six-DOF hybrid manipulator, and the Stewart platform.

Velocity analysis and statics of manipulators

Introduction; Linear and angular velocities of a rigid body; Linear and angular velocities of links in serial manipulators - the planar 3R manipulator; Serial manipulator Jacobian; Parallel manipulator Jacobians - the planar four-bar mechanism and a three-DOF parallel manipulator, Statics of serial manipulators - the planar 3R manipulator; Statics of parallel manipulators.

UNIT IV

Dynamics of manipulators

Introduction; Inertia of a link; The Lagrangian formulation - equations of motion of a planar 2R manipulator, and equations of motion of a planar four-bar mechanism; Dynamic equations in cartesian space; Inverse dynamics of manipulators - inverse dynamics of planar 2R manipulator; Simulation of equations of motion - simulation of a planar 2R manipulator, and simulation of a planar four-bar mechanism.

Trajectory planning and generation - Introduction; Joint space schemes - a cubic trajectory; Joint space schemes with via points - a cubic trajectory with a via point, and a cubic trajectory with matching velocity, and acceleration at a via point; Cartesian space schemes - cartesian straight line motion, cartesian circular motion, and trajectory planning for orientation; Additional issues;

UNIT V

Position and force control of manipulators

Introduction; Feedback control of a single-link manipulator – usefulness of feedback, first-order system, second-order system, PID control of a single-link manipulator, and digital control of a single-link manipulator; PID control of a multi-link manipulator; Non-linear control of manipulators-time required to compute the model; Lack of knowledge of model parameters; Simulation and experimental results - simulation results, and experimental results; Non-linear control of constrained and parallel manipulators; Cartesian control of manipulators; Force control of manipulators - Force control of a single mass, and partitioning a task for force and position control - case study: peg-in-hole assembly.

Overview of robot actuators and feedback components

TEXT BOOK

Robotics: Fundamental Concepts and Analysis *by* Ashitava Ghosal; *Publisher: Oxford University Press*.

REFERENCE

1. Robot Dynamics and Control by M.W.Sponge and M.Vidyasagar; *Publisher: John Wiley*.

2. Introduction to Robotic Mechanics and Control by JJ Craig; *Publisher: Pearson education.*
3. Robotics by K.S.Fu; *Publisher: McGraw Hill.*
4. Industrial Robotics by M.P.Groover; *Publisher: Pearson Education.*

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Elective II	4	0	4

(R11EEE1134) AUTOMOTIVE ELECTRICAL AND AUTOTRONICS

UNIT I

STORAGE BATTERY

Principles of lead acid cells and their characteristics. construction and working of lead acid battery. types of batteries, testing of batteries, effect of temperature on capacity and voltage, battery capacity, voltage, efficiency, charging of batteries, sulphation and desulphation, maintenance and servicing. Fault diagnosis. New developments in electrical storage.

CHARGING SYSTEM

Principle of generation of direct current. Principle, construction and working of alternator generating systems. Maintenance, servicing and trouble shooting. Bosch compact alternator:

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, distributor-less ignition.

STARTER MOTOR

Construction and working of series and shunt automotive starter motor, types of device arrangement, solenoid switches, starter motor troubles and repairs.

Electronic controls of carburetion: component of fuel injection systems, multipoint injection. Bosch L-variation electronic control diesel fuel injection.

UNIT III

WIRING FOR AUTO ELECTRICAL SYSTEMS

Earth return and insulated return systems, six volt and twelve volt systems, fusing of circuits, low and high voltage automotive cables, wiring diagram for typical automotive wiring systems, maintenance and servicing.

DASH BOARD UNITS AND ELECTRICAL ACCESSORIES

Principle of automobile illumination, head lamp construction and wiring, horn, wind screen wiper signaling devices, fog lamps, auxiliary lighting , temperature gauge, oil pressure gauge, fuel gauge, speedometer, odometer.

UNIT IV

NUMBER SYSTEM CODES AND DATA REPRESENTATION

Binary numbers, number base conversion, decimal, octal and hexa-decimal numbers, BCD codes, memory representation of positive and negative integers, conversion real numbers. floating point notations and representations of floating point numbers, binary arithmetics, addition and subtraction of binary numbers, ones and two's complement method.,

UNIT V

LOGIC GATES, ARITHMETIC CIRCUITS AND INTRODUCTION TO MICROPROCESSORS

Study of basic and universal logic gates, study of X-OR and X-NOR gates. flip flop, S-R, S-J flip flop and counters and shift resistance, half adders and subtractors.

TEXTBOOKS

1. Automotive Electrical auxiiajy systems,By N. R. Khatawale
2. Digital Logic and Computer Design by Mano, Prentice Hall of India

REFERENCES

I. Automotive Electrical systems,By Young and Griffith, Butterworth
2 Basic automotive electrical systems,By C.P.Nakra, Dhanpat Rai.
3. Automotive mechanics,By William H. Grouse, TMH
4. Modem Electrical Equipments,By A. W. Judge,
5. Automotive Electrical Equipment,By P.L. Kohli, TMH

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Elective II	4	0	4

(R11MED1132) ADVANCED MACHINE DESIGN

UNIT I

Load determination

Introduction; Loading classes; Free-body diagrams; Loads analysis – three dimensional analysis, two dimensional analysis, and static load analysis; Two-dimensional static loading case studies – case study 1A – bicycle break lever loading analysis, case study 2A – hand operated crimping – tool loading analysis, case study 3A – automobile scissors – jack loading analysis; Three-Dimensional, static loading case study – case study 4A – bicycle break arm loading analysis; Dynamic loading case study – case study 5A – four bar linkage loading analysis; Vibration loading – natural frequency, dynamic forces, and case study 5b – four bar linkage dynamic loading measurement; Impact loading – energy method; Beam loading – shear and moment, Singularity functions, and Superposition.

UNIT II

Static failure theories

introduction; Failure of ductile materials under static loading – the Von Mises-Hencky or distortion-energy theory, the maximum shear-stress theory, maximum normal-stress theory, and comparison of experimental data with failure theories; Failure of brittle materials under static loading – even and uneven materials, the Colomb-Mohr theory, the modified-Mohr theory, fracture-mechanics – fracture mechanics theory, fracture toughness Kc; Using the static-loading failure theories; Case studies in static failure analysis – case study 1C – bicycle break lever failure analysis, case study 2C – crimping – tool failure analysis, case study 3C – automobile scissors – jack failure analysis, and case study 4C – bicycle break arm factors of safety

UNIT III

Fatigue failure theories

Introduction - history of fatigue failure; Mechanism of fatigue failure – crack-initiation stage, crack propagation stage, and fracture; Fatigue-failure models – fatigue regimes, the stress-life approach, the strain-life approach, the LEFM approach; Machine design considerations; Fatigue loads – rotating machinery loading, and service equipment loading.

UNIT IV

Surface failure

Introduction; Surface geometry; Mating surfaces; Friction – effect of roughness on friction, effect of velocity on friction, rolling friction, and effect of lubricant on friction; Adhesive wear – the adhesive wear coefficient; Abrasive wear – abrasive materials, and abrasion-resistant materials; Corrosion wear – corrosion fatigue, and fretting corrosion; Surface fatigue; Spherical contact – contact pressure and contact patch in spherical contact, static stress distributions in spherical contact; Cylindrical contact - contact pressure and contact patch in parallel cylindrical contact, and static stress distributions in parallel cylindrical contact;

General contact - contact pressure and contact patch in general contact, and stress distribution in general contact; Dynamic contact stresses – effect of sliding component on contact stresses.

UNIT V

Design case studies

Introduction; Case study 7 – A portable air compressor – case study 7a – preliminary design of a compressor drive train; Case study 8 – A hay-bale lifter – Case study 8a – preliminary design of a winch lift; Case study 9 – A cam – testing machine – case study 9a - preliminary design of a cam dynamic text fixture (CDTF)

TEXT BOOK

Machine Design: Integrated Approach *by* Robert L. Norton; *Publisher: Pearson Education.*

REFERENCE

1. Mechanical Engineering Design (SI edition) *by* J.E. Shigley; *Publisher: McGraw Hill.*
2. Mechanical Engineering Design (SI edition) *by* J.E.Shigley and Mischke.
3. Mechanical Engineering Design (International edition) *by* J.E.Shigley, Mischke, and Budynas; *Publisher: McGraw Hill.*
4. Mechanical Engineering Design (International edition) *by* J.E.Shigley, Mischke, R.G.Budynas, and K.J.Nisbett; *Publisher: TMH.*

IV Year B.Tech AE I SEM	L	T/P/D	C
Elective III	4	0	4

(R11AME1106) VEHICLE TRANSPORT MANAGEMENT

UNIT I

HISTORICAL BACKGROUND

Introduction, the growth of a network, trams, trolley buses, private car's subsidies.

THE INFRASTRUCTURE

Road, Approach Road. Highways National, State, District, traffic condition, relief of congestion, pedestrians, zebra lines, margins, shopping centers. Bus-stops. shelters. Bus stations. Garages layout of premises, equipment, use of machinery, conveyance of staff, facilities for passengers. Maintenance, preventive, breakdown, overhauling, major, minor.

UNIT II

ORGANISATION AND MANAGEMENT

Forms of ownership, principle of transport, management, internal organization, centralized condition, decentralized condition (Engineering, traffic and administration), staff administration: industrial relation, administration, recruitment and training, welfare, health and safety.

PUBLIC RELATIONS DIVISIONS

Dissemination of information, maintaining goodwill- handling complaints, traffic advisory, committees- local contractors co-operation with the press news and articles-, facilities for visitors- forms of publicity importance of quality, inter departmental liaison advertisements, signs,, notice and directions general appearance of premises, specialized publicity.

UNIT III

PREVENTION OF ACCIDENTS

Emphasis of safe driving-annual awards bonus encouragement vehicle design platform, layout, location of steps, scheduled route hazards records elimination of accident prone devices.

ROUTE PLANNING

Source of traffic, town planning. turning points, stopping places, shelters survey of route preliminary schedule test runs elimination of hazards factors affecting. Frequency direction of traffic flow estimated traffic possibility single verses double deck.

TIMING, BUS WORKING AND SCHEDULES

Time table layout uses of flat graph method of presentation preparation of vehicle and crew schedule preparation of the duty roster, co-operation with employers use of the vehicle

running numbering determination of vehicle efficiency, checking efficiency of crew, duty arrangements.

UNIT IV

FARE COLLECTIONS SYSTEMS

Principles of collection the way bill, bell punch system reduced ticket stocks wilk brew system T.I.M and straight /M/C/S. The verometer lenson parason coach tickets exchanges, box system personal and common stock flat fare platform, control.

THE FARE STRUCTURE

Basis of fares historical background effects of competition and control calculating average zone system straight and tapered scale elastic and inelastic demand coordination of fares concessions fares changes for workman. Anomalies double booking inter availability through booking and summation private hire charges.

UNIT V

OPERATING COST AND TYPES OF VEHICLES

Classification costs, average speed running costs supplementary costs depreciation obsolescence, life of vehicles sinking fund factor affecting post per vehicles mile incidence of wages and overheads 100 seats miles basis, average seating capacity vehicles size and spread overs, types of vehicle economic considerations authorization of trolley, bus services, statuary procedure taxes and hire cars.

TEXT BOOKS

1. Bus Operation, L.D. Kitchen, Cliffe and Sons.
2. Bus and Coach Operation, Rex W. Faulks, Butterworth Version Of 1987

REFERENCES

1. Compendium of Transport Terms, CIRT, Pune
2. M.V. Act 1988 Central Law Agency, Allahabad
3. The Elements Of Transportation,R.J. Eaton
4. Goods Vehicle Operation, By C.S. Dubbar
5. Road Transport Law — L.D.Kitchen
6. Compendium Of Transport Terms CIRT, Pune (Report
7. M.V .Act 1988, Pub Central Law Agency, Allahabad.

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Elective III	4	0	4

(R11MED1133) MECHATRONICS

UNIT I

Introduction

Scope of mechatronics; Systems; Measurement systems; Control systems, Microprocessor-based controllers; Response of systems; The mechatronics approach.

Sensors and transducers

Introduction; Performance terminology, Displacement, position and proximity; Velocity and motion; Force; Fluid pressure; Liquid flow; Liquid level; Temperature; Light sensors; Selection of sensors; Inputting data by switches.

UNIT II

Signal conditioning

Introduction; The operational amplifier; Protection; Filtering, Wheatstone bridge; Digital signals; Multiplexers; Data acquisition; Digital signal processing; Pulse modulation.

Data presentation systems

Displays; Data presentation elements; Magnetic recording; Data acquisition systems; Measurement systems, Testing and calibration.

UNIT III

Pneumatic and hydraulic actuation systems

Actuation systems; Pneumatic and hydraulic systems; Directional control valves; Pressure control valves; Cylinders; Process control valves; Rotary actuators.

Mechanical actuation systems

Mechanical systems; Types of motion; Kinematic chains; Cams, Gear trains; Ratchet and pawl; Belt and chain drives; Bearings; Mechanical aspects of motor selection.

UNIT IV

Electrical actuation system

Electrical systems; Mechanical switches; Solid-state switches; Solenoids; DC Motors; AC Motors; Stepper motors.

Basic system models

Mathematical models; Mechanical systems building blocks; Electrical system building blocks; Fluid system building blocks; Thermal system building blocks.

System models

Engineering systems; Rotational–translational systems; Electro-mechanical systems; Hydraulic-mechanical systems.

UNIT V

Dynamic responses of systems

Modeling dynamic systems; First order systems; Second order systems; Performance measures for second order systems; System identification.

System transfer function

The transfer function; First order systems; Second order systems,; Systems in series; Systems with feed back loops; Effect of pole locations on transient response.

Closed loop controllers

Continuous and discrete processes; Control modes; Two step mode; Proportional mode; Derivative control; Integral control; PID controller; Digital controllers; Control system performance; Controller tuning, Velocity control, Adaptive control.

Microprocessors

Control; Microprocessors systems; Microcontrollers; Applications; Programming.

TEXT BOOK

Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering *by* W. Bolton; *Publisher: Pearson Education*.

REFERENCE

1. Mechatronics; *Publisher: HMT and TMH*
2. Introduction to Mechatronics and Measurement Systems by David G. Alciatore, Michael B.Histand; *Publisher: McGraw Hill.*
3. Mechatronic System Design by Devdas Shetty and Richard A. Kolk; *Publisher: Cengage Learning.*
4. INSTRUMENTATION *by* B.E. Noltingk (Part Numbers 1, to 5); *Publisher: Butterworth-Heinemann*

IV Year B.Tech AE I SEM	L	T/P/D	C
Elective III	4	0	4

(R11MED1134) ADVANCED MECHANICS OF SOLIDS

UNIT I

Linear stress-strain-temperature relations

First law of thermodynamics, internal energy density, and complementary internal energy density – elasticity and internal-energy density, and elasticity and complementary internal-energy density; Hooke's law: anisotropic elasticity; Hooke's law: isotropic elasticity – isotropic and homogeneous materials, and strain-energy density of isotropic materials; Equations of thermoelasticty for isotropic materials; Hooke's law: orthotropic materials.

Inelastic material behavior

Limitations on the use of uniaxial stress-strain data – rate of loading, temperature lower than room temperature, temperature higher than room temperature, unloading and load reversal, and multiaxial states of stress; Nonlinear material response – models of uniaxial stress-strain curves; Yield criteria: general concepts – maximum principal stress criterion, maximum principal strain criterion, and strain-energy density criterion; Yielding of ductile metals – maximum shear-stress (Tresca) criterion, distortional energy density (von mises) criterion, and effect of hydrostatic stress and the π-plane; Alternative yield criteria – Mohr-coulomb yield criterion, Drucker-Prager yield criterion, and Hill's criterion for orthotropic materials; General yielding – elastic-plastic bending, fully plastic moment, shear effect on inelastic bending, modulus of rupture, comparison of failure criteria, and interpretation of failure criteria for general yielding.

UNIT II

Curved beams

Introduction; Circumferential stresses in a curved beam – location of neutral axis of cross section; Radial stresses in curved beams – curved beams made from anisotropic materials; Correction of circumferential stresses in curved beams having I, T, or similar cross sections – Bleich's correction factors; Deflections of curved beams – cross sections in the form of an I, T, etc.; Statically indeterminate curved beams: closed ring subjected to a concentrated load; Fully plastic loads for curved beams – fully plastic versus maximum elastic loads for curved beams.

UNIT III

Beams on elastic foundations

General theory; Infinite beam subjected to concentrated load: boundary conditions – method of superposition, and beam supported on equally spaced discrete elastic supports; Infinite beam subjected to a distributed load segment – uniformly distributed load, $\beta L' \leq \pi$, $\beta L' \rightarrow \infty$, intermediate values of $\beta L'$, and triangular load; Semiinfinite beam subjected to loads at its end; Semiinfinite beam with concentrated load near its end; Short beams; Thin-wall circular cylinders.

UNIT IV

The thick-wall cylinder

Basic relations – equations of equilibrium, strain-displacement relations and compatibility condition, stress-strain-temperature relations, and material response data; Stress components at sections far from ends for a cylinder with closed ends – open cylinder; Stress components and radial displacement for constant temperature – stress components, radial displacement for a closed cylinder, and radial displacement for an open cylinder; Criteria of failure – failure of brittle materials, failure of ductile materials, material response data for design, and ideal residual stress distributions for composite open cylinders; Fully plastic pressure and autofrettage; Cylinder solution for temperature change only – steady-state temperature change (distribution), and stress components; Rotating disks of constant thickness.

UNIT V

Flat plates

Introduction; Stress resultants in a flat plate; Kinematics: strain-displacement relations for plates – rotation of a plate surface element; Equillibrium equations for small-displacement theory of flat plates; Stress-strain-temperature relations for isotropic elastic plates – stress components in terms of tractions and moments, and pure bending of plates; Strain energy of a plate; Boundary conditions for plates; Solution of rectangular plate problems – Solution of $\nabla^2 \nabla^2 w = P/D$ for a rectangular plate, Westerguaard approximate solution for rectangular plates: uniform load, deflection of a rectangular plate: uniformly distributed load;

Solution of circular plate problems – solution of $\nabla^2 \nabla^2 w = P/D$ for a circular plate, circular plates with simply supported edges, circular plates with fixed edges, circular plate with a circular hole at the center; summary of circular plates with simply supported edges, summary for stresses and deflections in flat circular plates with central holes, summary for large elastic deflections of circular plates: clamped edge and uniformly distributed load, significant stress when edges are clamped, load on a plate when edges are clamped, summary for large elastic deflections of circular plates: simply supported edge and uniformly distributed load, rectangular or other shaped plates with large deflections.

Contact stresses

Introduction; The problem of determining contact stresses; Geometry of the contact surface – fundamental assumptions, contact surface shape after loading, justification, and brief discussion of the solution; Notation and meaning of terms; Expressions for principal stresses; Method of computing contact stresses – principal stresses, maximum shear stress, maximum octahedral shear stress, maximum orthogonal shear stress, and curves for computing stresses for any value of B/A; Deflection of bodies in point contact – significance of stresses; Stress for two bodies in line contact: loads normal to contact area – maximum principal stresses:*k*=0, maximum shear stress:*k*=0, and maximum octahedral shear stress:k=0; Stresses for two bodies in line contact:loads normal and tangent to contact area – roller on plane, principal stresses, maximum shear stress, maximum octahedral shear stress, effect of magnitude of friction coefficient, and range of shear stress for one load cycle.

Overview of creep: time-dependent deformation.

TEXT BOOK

Advanced Mechanics of Materials (6E) by Arthur P. Boresi and Richard J. Schmidt; *Publisher: John Wiley.*

REFERENCE

Strength of Materials (part 2): Advanced Theory and Problems *by* Stephen Timoshenko; *Publisher: CBS.*

IV Year B.Tech AE I SEM	L	T/P/D	C
Elective III	4	0	4

(R11MED1136) TRIBOLOGY

UNIT I

Introduction to the concept of tribodesign

Specific principles of tribodesign; Tribological problems in machine design - plain sliding bearings, rolling contact bearings, piston, piston rings, cylinder liners, friction drives, overview of gears.

Basic principles of tribology

Origins of sliding friction; Contact between bodies in relative motion; Friction due to adhesion; Friction due to ploughing; Friction due to deformation; Energy dissipation during friction; Friction under complex motion conditions; Types of wear and their mechanisms - adhesive wear, abrasive wear, wear due to surface fatigue, and wear due to chemical reactions; Sliding contact between surface asperities; The probability of surface asperity contact.

UNIT II

(Cont'd) **Basic principles of tribology**

Wear in lubricated contacts - rheological lubrication regime, functional lubrication regime, fractional film defect, load sharing in lubricated contacts, adhesive wear equation, and fatigue wear equation; Relation between fracture mechanics and wear **-** estimation of stress intensity under non-uniform applied loads; Film lubrication - coefficient of viscosity, fluid film in simple shear, viscous flow between very close parallel surfaces, shear stress variations within the film, lubrication theory by Osborne Reynolds, high-speed unloaded journal, equilibrium conditions in a loaded bearing, loaded high-speed journal, equilibrium equations for loaded high-speed journal, reaction torque acting on the bearing, the virtual coefficient of friction, and the Sommerfeld diagram.

UNIT III

Elements of contact mechanics

Introduction; Concentrated and distributed forces on plane surfaces; Contact between two elastic bodies in the form of spheres; Contact between cylinders and between bodies of general shape; Failures of contacting surfaces; Design values and procedures;

Thermal effects in surface contacts - analysis of line contacts, refinement for unequal bulk temperatures, refinement for thermal bulging in the conjunction zone, the effect of surface layers and lubricant films, critical temperature for lubricated contacts, the case of circular contact, contacts for which size is determined by load, and maximum attainable flash temperature;

Contact between rough surfaces - characteristics of random rough surfaces, and contact of nominally flat rough surfaces; Representation of machine element contacts.

UNIT IV

Friction, lubrication and wear in lower kinematics pairs

Introduction; The concept of friction angle - friction in slideways, and friction stability; Friction in screws with a square thread - application of a threaded screw in a jack; Friction in screws with a triangular thread; Plate clutch - mechanism of operation; Cone clutch - mechanism of operation - driving torque; Rim clutch - mechanism of operation - equilibrium conditions, auxiliary mechanisms, and power transmission rating; Centrifugal clutch - mechanism of operation; Boundary lubricated sliding bearings - axially loaded bearings, and pivot and collar bearings; Drives utilizing friction force - belt drive, mechanism of action, power transmission rating, relationship between belt tension and modulus, and V-belt and rope drives; Overview of frictional aspects of brake design.

UNIT V

Sliding-element bearings

Derivation of the Reynolds equation; Hydrostatic bearings; Squeeze-film lubrication bearings; Thrust bearings **-** flat pivot, the effect of the pressure gradient in the direction of motion, equilibrium conditions, and coefficient of friction and critical slope; Journal bearings - geometrical configuration and pressure generation, mechanism of load transmission, thermoflow considerations, design for load-bearing capacity, unconventional cases of loading, numerical example.

TEXT BOOK

Tribology in Machine Design *by* T.A. Stolarski; *Publisher: Butterworth and Heinemann/Industrial Press.*

REFERENCE

1. Tribology: Friction and Wear of Engineering Materials by I.M.Hutchings; *Publisher: Edward Arnold.*
2. Industrial Tribology: The Practical Aspects of Friction, Lubrication and Wear by M.H.Jones and Douglas Scott; *Publisher: Elsevier*

IV Year B.Tech AE I SEM	L	T/P/D	C
Elective IV		3	0	3

(R11MED1139) UNCONVENTIONAL MACHINING PROCESSES

UNIT I

Early progress in machining;

Electron beam machining (EBM)

Introduction; Basic equipment; Emission current; Theoretical considerations; Rates of material removal in EBM; Surface roughness of work piece in EBM; Heat-affected zone; Applications of EBM.

Ion beam machining

Introduction; Ion beam machining system; Collision mechanism; Rates of material removal in IBM; Accuracy and surface effects; Applications.

UNIT II

Electrochemical machining

Introduction; Electrolysis; Characteristics of ECM; Basic working principles; Industrial electrochemical machine; Rates of machining; Surface finish in ECM; Accuracy and dimensional control; Overview of theory of shaping in ECM; Applications; Special ECM applications.

UNIT III

Laser machining

Introduction; Spontaneous emission of radiation; Stimulated emission; Laser oscillation; Types of laser; Laser beam characteristics; Effects of laser on materials; Effects of work piece material; Overview of Rates of machining and heat-affected zones; Applications.

Electro discharge machining

Introduction; Lazarenko relaxation (RC) circuit; Development of controlled pulse generators; Mechanism of materiel removal; Dielectric fluids; Tool materials; Overview of metal removal rates, surface effects, and accuracy; Applications.

UNIT IV

Overview of Plasma arc machining

Ultrasonic machining (USM)

Introduction; Principles of USM; Mechanism of material removal; Brittleness criterion; Effects of process conditions on rate of USM; Theory of material removal rates in USM; Surface finish; Accuracy; Applications; Ultrasonic twist drilling; Industrial ultrasonic machine.

UNIT V

Water-jet machining

Introduction; Basic equipment; Theoretical considerations; Advantages of WJM, Applications.

TEXT BOOK

Advanced Methods of Machining *by* J.A. McGeough; *Publisher: Chapman and Hall.*

REFERENCE

1. Manufacturing Engineering and Technology *by* Serope Kalpakjian and Steven R. Schmid; *Publisher: Pearson.*
2. New Technology by A. Battacharya; *Publisher: The Institution of Engineers, India, 1984.*

IV Year B.Tech AE I Sem	T	T/P/D	C
Elective IV	3	0	3

(R11AME1107) VEHICLE BODY ENGINEERING AND SAFETY

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, interior ergonomics. Ergonomics system design, dashboard instruments, advances in electronic display, CV legal dimension. CV- cab ergonomics, mechanical package layout.

UNIT III

AERODYNAMICS

Basics, aerofoils, aerodynamics drag lift, pitching, yawing and rolling moments, determination of aerodynamic coefficients (wind tunnel testing). racing car aerodynamics. bluff body aerodynamics, local air flows.

LOAD DISTRIBUTION

Types of load carrying structures,closed, integral, open, flat types. Calculation of loading cases- static, asymmetric, vertical loads. Load distribution, stress analysis of structure, body shell analysis.

UNIT IV

NOISE, VIBRATION, HARSHNESS

Noise and vibration basics. body structural vibrations, chassis bearing vibration, designing against fatigue, rubber as an isolator. CV body mountings. automatic enclosures, sandwich panels, structure dynamics applied, surety under impact: Impact protection basics. design for crash worthiness, occupant and cargo restraints. Passive restraint systems, slide impact analysis, bumper system, energy absorbant foams, laws of mechanisms applied to safety.

VEHICLE STABILITY

Steering geometry vehicle and a curvilinear path, and lateral stability. etfects of tyre factors. mass distribution and engine location on stability.

UNIT V

BODY FITTING AND I CONTROLS

Driver's seat, window winding mechanism, Door lock mechanism, other interior mechanisms, driver's visibility' and tests for, visibility, minimum space, requirements and methods or improving space in cars. electric wiring and electronic control systems, advanced body electronics, networking or body systems controls.

VANS, TRUCKS AND BUSES

Types of mini coach with trailers, single and double deckers. design criteria based on passenger capacity; goods to be transported and distance to be Covered, constructional details: weights and dimensions; conventional and integral type.

TEXT BOOKS

1. Body Engineering,*by* Sydney F Page
2. Vehicle body engineerin *by* Gilcs J Pawlowski,

REFERENCES

1. Automotive chassis,P.M. Heldt. chilton and Co
2. Handbook on vehicle body design,SAE Publications.

IV Year B.Tech AE I SEM	L	T/P/D	C
Elective IV	3	0	3

(R11MED1140) PLANT LAYOUT AND MATERIAL HANDLING

UNIT I

Plant layouts

Fundamentals of plant layouts; Software tools used for making plant layouts; Case studies Overview of process Layout and product layout;

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.

UNIT II

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 III

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.

UNIT IV

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.

UNIT V

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 BOOK

1. Material Handling Equipment *by* N. Rudenko; *Publisher: Peace publishers.*
2. Facility layout, location and analytical approach by R.L. Francis, L.F. McLinnis Jr., White; *Publisher: PHI*

IV Year B.Tech AE I SEM	L	T/P/D	C
Elective IV	3	0	3

(R11MED1141) COMPUTATIONAL FLUID DYNAMICS

BASIC THOUGHTS AND EQUATIONS

UNIT I

Philosophy of Computational Fluid Dynamics

Need for computational fluid dynamics; Computational fluid dynamics as a research tool; Computational fluid dynamics as a design tool; The impact of computational fluid dynamics – examples - automobile and engine applications, industrial manufacturing applications, civil engineering applications, environmental engineering applications, naval architecture applications (submarine example); computational fluid dynamics technique.

The Governing Equations of Fluid Dynamics - Derivation, Physical Meaning, and Forms Particularly Suitable to CFD

Introduction; Models of the flow - Finite control volume, and infinitesimal fluid element; The substantial derivative (time rate of change following a moving fluid element); The divergence of the velocity - its physical meaning;

The continuity equation - model of the finite control volume fixed in space, model of the finite control volume moving with the fluid, model of an infinitesimally small element fixed in space, model of an infinitesimally small fluid element moving with the flow, integral versus differential form of the equations, and similarities and differences in equations;

The momentum equation; The energy equation;

Summary of the governing equations for fluid dynamics - equations for viscous flow (the navier-stokes equations), equations for inviscid flow (the Euler equations);

Physical boundary conditions; Forms of the governing equations particularly suited for CFD.

UNIT II

Mathematical behavior of partial differential equations - the impact on CFD

Introduction; Classification of quasi-linear partial differential equations; A general method of determining the classification of partial differential equations - the eigenvalue method; General behavior of the different classes of partial differential equations - impact on physical and computational fluid dynamics - hyperbolic equations, parabolic equations, elliptic equations, and applications.

BASICS OF THE NUMERICS

UNIT III

Basic aspects of discretization

Introduction; Introduction to finite differences; Difference equations; Explicit and Implicit approaches - definitions and contrasts; Errors and an analysis of stability.

Grids with appropriate transformations

Introduction; General transformation of the equations; Metrics and Jacobians; Convenient form of the governing equations particularly suited for CFD; Stretched (compressed) grids; Boundary-fitted coordinate systems; Elliptic grid generation.

UNIT IV

Introduction to CFD Techniques

Introduction; The Lax-Wendroff technique; MacCormack's technique;
Viscous flows, conservation form, and space marching; The relaxation technique and is use with low-speed inviscid flow; Aspects of numerical dissipation and dispersion - artificial viscosity; The alternating-direction-implicit (ADI) technique.

UNIT V

(Contd) Introduction to CFD Techniques

The pressure correction technique - application to incompressible viscous flow - the incompressible navier-stokes equations, Central differencing of the incompressible Navier-stokes equations - the need for a staggered grid; The philosophy of the pressure correction method; The pressure correction formula; The numerical procedure - the SIMPLE algorithm; Boundary conditions for the pressure correction method.
APPLICATIONS
Numerical solutions of quasi-one-dimensional nozzle flows – simple problems
Overview of Numerical solution of a two-dimensional supersonic flow- Prandtl-Meyer expansion wave

TEXT BOOK

Computational Fluid Dynamics: the basics with applications *by* John D. Anderson, Jr.; *Publisher: McGraw Hill*

REFERENCE

1. Computational Fluid Dynamics: An Introduction by J.F.Wendt and J.D.Anderson; Publisher: Springer
2. Computational Fluid Dynamics by J.Blazek; Publisher: Elsevier.

IV Year B.Tech. AE I SEM	L	T/P/D	C
	0	3	2

(R11AME1203) AUTOMOBILE ENGINEERING LAB

Part A
Primary inspection of the engine condition
Demounting the automotive engine
Mounting of automotive engine
Connections for automotive engine
Air conditioning test

Part B
Advanced Fabrication of automotive body parts.
Advanced Joining processes for automotive body parts.
Advanced Assembly of automotive body parts.
Advanced Automotive body building.

IV Year B.Tech. AE I SEM	L	T/P/D	C
	0	3	2

(R11MED1209) CAD/ CAM LAB

12 experiments from the following syllabus:

1. Part Modeling**:** Generation of 3D models of various parts using feature based and parametric software;
   Creation of various features; Study of parent child relation;
   Surface and assembly modeling; Study of various standard translators.
2. Finite element analysis
   a) Determination of deflection and stresses in 2D and 3D trusses and beams.
   b) Determination Principal/ Von-Mises stresses and deflections, in plane stress/ plane strain/ axisymmetric models.
   c) Determination of stresses in 3D and shell structures.
   d) Estimation of natural frequencies and mode shapes, and harmonic response of 2D beam.
3. Computer aided manufacturing
   a) Development of process sheets for various components.
   b) Development of manufacturing and tool management systems.
   c) Study of various post processors used in NC Machines.
   d) Development of NC code for turning and milling jobs using CAM packages.
   e) Machining of simple components on NC lathe and Mill by transferring NC Code/ from a CAM package through RS 232.
   f) Quality Control and inspection.

IV Year B.Tech AE I sem	L	T/P/D	C
	3	1	3

(R11MED1121) FINITE ELEMENT METHOD

UNIT I

Fundamental concepts

Introduction; Historical background; Stresses and equilibrium; Boundary conditions; Strain-displacement relations; Stress-strain relations; Temperature effects; Potential energy and equilibrium - the Rayleigh-Ritz method; Galerkin's method; Saint Venant's principle; Von Mises stress.

Matrix algebra and Gaussian elimination

Matrix algebra; Gaussian elimination; Conjugate gradient method for equation solving.

One-dimensional problems

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

UNIT II

Trusses

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

Two-dimensional problems using constant strain triangles

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

UNIT III

Axisymmetric solids subjected to axisymmetric loading

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

UNIT IV

Two-dimensional isoparametric elements and numerical integration

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

UNIT V

Beams and frames

Introduction; Finite element formulation; Load vector; Boundary considerations; Shear force and bending moment; Beams on elastic supports; Plane frames; Three-dimensional frames.

Overview of Three-dimensional problems in stress analysis

TEXT BOOK

Introduction to Finite Elements in Engineering, 2E, *by* Tirupathi R. Chandrupatla, Ashok D. Belegundu; *Publisher: Prentice Hall of India.*

REFERENCE

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

IV Year B.Tech AE I SEM	L	T/P/D	C
Elective V	3	0	3

(R11AME1108) AUTO AIR CONDITIONING

UNIT I

FUNDAMENTALS OF REFRIGERATION

Vapour compression refrigeration, working principle, cycle COP, refrigeration cycle in T-s and P-h coordinates, Effect of sub cooling and super heating and cycle analysis and problems using P-h charts. Refrigerants used in Automobiles — properties

UNIT II

INTRODUCTION TO AIR CONDITIONING

Psychrometric properties and processes, sensible and latent heat loads, characterization and SHF load for ventilation and filtration, concepts of RSHFand SHF ESHF and ADP, concepts of human comfort and effective temperature.

Vehicle cooling, load estimation, capacity requirements of Air Conditioning System.

UNIT III

COMPONENTS OF AIR CONDITIONERS

Air-conditioning Components: Compressor- Evaporator-Condenser- Expansion valve, Receiver Drier- Filters-Mufflers, special features-compressor protection Anti freezing relay. Air Heating equipment, Ducts, Registers and Grills, blowers, filters.

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.

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-trouble shooting 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, repairs on compressors.

TEXT BOOK

Automotive Air-conditioning- By William H.Crouse and Donald L.Anglin. MH

REFERENCES

1. Automotive Air-conditioning- By Lesile F.Gomgs. McGrawHil l
2. Automotive Air-conditioning- By Boyce H.Dwiggins. Reston Pub.
3. Refrigeration and Air Conditioning by Manohar Prasad
4. Refrigeration and Air Conditioning by C.P.Arora

IV Year B.Tech AE II SEM	L	T/P/D	C
Elective V	3	0	3

(R11MED1147) PRODUCTION PLANNING AND CONTROL

GENERAL

UNIT I

Functions of production planning and control (PPC)

Introduction; Materials; Methods; Machines and equipments; Routing; Estimating; Loading and scheduling; Dispatching; Expediting; Inspection; Evaluating;

Broad categories of functions of production planning and control - Preplanning, planning and control; Other industrial engineering functions that have interdependency with PPC - Plant layout, simplification and standardization, time and motion study, and Inventory control.

Manufacturing systems

Types of production - job production, batch production, and continuous production; Size of pants; Types of industry.

Production procedure

The production cycle; Coordination of production decisions - the product, the components and assemblies (or semi finished products), the means (7 M's; management: skill and potentialities; manpower; management: finance planning; matrix; materials; methods; machines); Departmental responsibilities.

Organization

Department sectionalization - Production planning, production control, and inventory control; Variations on the conventional pattern of organization – motion and time study, standards section, transportation section, and central statistics office; Centralized and decentralized production planning and control.

PREPLANNING

Product development and design

Company policy – Effect of competition on design, and long-range planning;

Product analysis – marketing aspect, and the product characteristics (functional aspect; operational aspect; durability and dependability; aesthetic aspect);

Economic analysis – profit and competitiveness, the three S's (simplification; specialization; standardization; preferred numbers), the break-even analysis, and the economics of a new design;

Production aspect.

UNIT II

Sales forecasting and estimating

About forecasting;

Restrictions of consumption – the product and its limitations, the consumer and his potential buying power, analysis of competition (competing for a share of the market), saturation (selling to satisfy demand; replacement), distribution and promotion methods (advertising; effectiveness of distribution channels; terms of sale), and state of business (pricing policies; business cycles);

Making the forecast – the market share, sales trend analysis, forecasting in seasonal demand, a trend analysis in seasonal demand, the use of indicators and correlation analysis, and combination of methods;

Effects of forecast on the production order; Accuracy of forecasts; Case studies in sales forecasting.

Plant layout

Introduction; Flow systems – horizontal flow lines (I-flow, L-flow, U-flow, S-flow, O-flow, unidirectional or retractional flow, integration of flow lines into an assembly line), and vertical flow lines (processing downwards or upwards; centralized or decentralized elevation; unidirectional or retractional flow; vertical or inclined flow; single or multiflow; flow between buildings);

Types of layouts – classification (product layout; process layout; static product layout), machine layout, materials handling, effect of automation on layout, symptoms of a bad layout, factors to be considered in layout planning, and templates and models.

Evaluation of materials and methods

Introduction; Value analysis – consideration of new techniques and materials;

Efficient utilization and selection of materials – criteria for selection of materials, machine speeds, hot processes, machine speeds, hot processes, surface characteristics, new materials, dimensional specifications, material utilization of a shop or a process, analysis of processes, and case studies;

Design for production – scope of modifications.

PLANNING

UNIT III

The production order

Schematic process outlines, process, and activity charts;

Production master programs – required data, long-term planning, programming component production; Operation and route sheets; Breakline of the production order; Stock planning; Basic production planning problems.

Quantities in batch production

Stock control; Definition of batch sizes; Minimum cost batch size – formulae, raymond's formula, lehoczky's formula, davis formula, use of formula, use of a monograph, a graphical method, a modified graphical method, equating the variable costs; The production range – determination of the production range, and effect on production costs; Maximum-profit batch size; Maximum return; Maximum rate of return; Comparison of the various criteria.

Batch-size determination under boundary conditions

Abrupt changes in the constant cost term, *c*; Breaks in the carrying cost factor, K; Breaks in the preparation costs, *s*; Combined breaks.

Machine capacity – typical problems**.**

UNIT IV

Scheduling

Forms of schedules – loading and scheduling, and basic scheduling problems;

Flow production scheduling for fluctuating demand – decision process, and production loading; Multiproduct scheduling in batch production;

The assignment problems – Distribution according to capacity, cost of operating production facilities, and effects of overtime or subcontracting;

Scheduling orders with random arrivals – problems of random-order scheduling, the simulation technique, other applications of the simulation technique; Product sequencing – sequence analysis, and minimum processing time.

Batch production scheduling

Introduction – sequence of batches; Optimizing the production schedule – maintaining stock level, specifying batch sizes, minimum costs per unit, maximium profit for the whole schedule, maximum returns to the whole schedule, and maximum rate of return for the whole schedule; Deriving a realistic solution – procedure; Multischeduling six products-a case study – preliminary data and first solution, determining the production range, testing the solution, methods of leading to modified solutions, increase the consumption period, relaxation of the production ranges, increase the capacity of the plant, modify the requirements, and relaxation of *p* for two-cycle production plans; Application of the theory to assembly work.

CONTROL

UNIT V

Elements of control procedures

Stages and activities of control – control of processes and production activities, quantity or inventory control, quality control, cost control; Dispatching and expediting; Recording progress – visual charts, and cumulative and weekly charts.

Computer-assisted production control

Introduction – computer requirements, and computer types and operation; Media for recording data – sales information, production control, payroll and assignment, and materials control; Installation of a computer-assisted production control system – sales analysis, product and materials analysis, schedule analysis, and designing a new procedure; Programming; Applications – stock control, and control of job production.

Inventory control

Significance; Effect of demand on inventories – restrictions on output increase, stock control systems, ordering procedures, the two-bin system, the ordering cycle system, and combinations of the two-bin and the ordering cycle systems; Reorder quantity – reorder range, effect of splitting an order; Reorder procedure – reorder point in the two-bin system, and reorder procedure in the cycle system; Effect of uncertainity – insufficient supply to customers, and insufficient supply to assembly line; Comparison of replenishment policies - the optimistic policy, the realistic policy, and the pessimistic policy.

TEXT BOOK

Elements of Production Planning and Control *by* Samuel Eilon; *Publisher: Universal Publishing Corporation (UPC)*.

REFERENCE

1. Fundamentals of Production Planning and Control *by* S.N.Chapman; *Publisher: Pearson Education*.
2. Operations Management *by* Chase; *Publisher: PHI*.

IV Year B.Tech AE II SEM	L	T/P/D	C
Elective V	3	0	3

(R11MED1149) OPERATIONS RESEARCH

UNIT I

Introduction

The origins of operations research; The nature of operations research; The impact of operations research; Algorithms and OR courseware.

Overview of the operations research modeling approach

Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation; Conclusions.

UNIT II

Introduction to linear programming

Applications; The linear programming model; Assumptions of linear programming; Some classic case studies; Formulating and solving linear programming models on a spreadsheet; Formulating very large linear programming models.

UNIT III

Solving linear programming problems: the simplex method

The essence of the simplex method; Setting up the simplex method; The algebra of the simplex method; The simplex method in tabular form; Tie breaking in the simplex method; Adapting to other model forms; Postoptimality analysis; Computer implementation; The interior-point approach to solving linear programming problems; Case studies.

The theory of the simplex method

Foundations of the simplex method; the revised simplex method; A fundamental insight.

UNIT IV

Duality theory and sensitivity analysis

The essence of duality theory; Economic interpretation of duality; Primal-dual relationships; Adapting to other primal forms; The role of duality theory in sensitivity analysis; The essence of sensitivity analysis; Applying sensitivity analysis; Performing sensitivity analysis on a spreadsheet; Case studies.

The transportation and assignment problems

Transportation problem**;** a streamlined simplex method for the transportation problem**;** Assignment problem.

UNIT V

Network optimization models

Applications; The terminology of networks; The shortest- path problem; The minimum spanning tree problem; The maximum flow problem; The minimum cost flow problem; The network simplex method; a network model for optimizing a projects time-cost trade-off; Case Studies.

Dynamic programming

A prototype example for dynamic programming; Characteristics of dynamic programming problems; Deterministic dynamic programming; Probability dynamic programming.

TEXT BOOK

Introduction to Operations Research *by* Frederick Hillier and Gerald Libermann; *Publisher: McGraw Hill.*

REFERENCE

1. Operations Research *by* Wagner; *Publisher: PHI*.
2. Operations Research *by* J.K.Sharma, 3rd edition; *Publisher: MacMillan*
3. Operations Research: A Practical Introduction *by* M.W.Carter and C.C.Price; *Publisher: CRC Press.*
4. Operations Research: Methods and Problems *by* Maurice Saseini, Arthur Yaspan and Lawrence Friedman.
5. The Operations Research Problem Solver *by* Research and Education Association; *Publisher: Research and Education Associates*.

IV Year B.Tech AE I SEM	L	T/P/D	C
Elective V	3	0	3

(R11MED1158) MAINTENANCE AND SAFETY ENGINEERING

UNIT I

Organization and management of the maintenance function

Redefining Maintenance — Delivering reliability; Introduction to the theory and practice of maintenance; Maintenance and reliability engineering; Cooperative partnerships; Effective maintenance organizations; Operating policies of effective maintenance; Six sigma safety - applying quality management principles to foster a zero-injury safety culture; Introduction to corrective maintenance, preventive maintenance, and predictive maintenance.

UNIT II

Maintenance of mechanical equipment

Plain bearings; Rolling-element bearings; Flexible couplings for power transmission; Chains for power transmission.

UNIT III

(Contd) **Maintenance of mechanical equipment**

Cranes - Overhead and gantry; Chain hoists; Belt drives; Mechanical variable-speed drives.

UNIT IV

(Contd) **Maintenance of mechanical equipment**

Gear Drives and speed reducers; Reciprocating air compressors; Valves; Pumps - Centrifugal and positive displacement.

UNIT V

Lubrication

The organization and management of lubrication; Lubricating devices and systems; Planning and implementing a good lubrication program.

TEXT BOOK

Maintenance Engineering Handbook *by* R. Keith Mobley, Lindley R. Higgins, and Derin J. Wikoff; *Publisher: Mc Graw Hill*

REFERENCE

Engineering Maintenance: A Modern Approach *by* B.S.Dhillon; Publisher: CRC Press.

IV Year B.Tech AE II SEM	L	T/P/D	C
Elective VI	3	0	3

(R11AME1109) AUTOMOTIVE POLLUTION AND CONTROL

UNIT I

Laws and Regulation

Historical background; Regulatory test procedures (European cycles); Exhaust gas pollutants (European rail road limits); Particulate pollutants; European statutory values; Inspection of vehicles in circulation (Influence of actual traffic conditions and influence of vehicle maintenance).

Economic challenges

Introduction; Cost of improvement to SI Engines; cost of injection systems, cost of improvement in diesel engines, Economic consequences of introducing the catalyst, additional costs incurred by diesel traps. Cost of periodic inspection of pollution control systems and evaporative control systems.

UNIT II

Analysis of pollutants

Carbon and nitrogen compounds -(CO, CO2, Nox), Ammonia and Amines, Hydrocarbons, Volatile compounds, evaporative losses, analysis of particulates

Pollutants from SI engines

Mechanism and Formation of HC, CO, and NOx in SL engines. Engine and operating variables affecting pollutants in SI engines.

Pollution for CI engines

Mechanism of formation of HC, CO, NOx, and root in CI engines. Factor affecting emissions in CI engines.

UNIT III

Lean burn and stratified charge engines

Multipoint fuel injection and Gasoline direct injection methods. Common rail fuel injection in diesel engines. Exhaust gas recirculation.

Post combustion treatments

Introduction, exhaust gas composition before treatment, catalytic converters, oxidation and three way types thermal reactors, installation of catalysts in exhaust lines, NOx treatment in diesel engines, particulate traps for diesel engines, particulate trap regeneration.

UNIT IV

Instrumentation for pollution measurements

NDIR- analyzer, thermal conductivity and flame ionization detectors, analyzers for NOx, gas chromatograph. Orsat apparatus, smoke meters- spot sampling and continuous indication types like Bosch, Hartridge. Particulate measuring systems. Dilution tunnels – full flow and partial flow.

UNIT V

Knock in SI and CI engines

Knock rating of SI and CI engine fuels, alternative fuel like hydrogen, natural gas, LP vegetable oil and bio diesel, their production, properties, storage and performance as engine fuels.

TEXT BOOKS

1. Bosch: Gasoline fuel injection- Bosch Publications
2. Bosch: Diesel fuel injection –Bosch Publications

REFERENCES

1. Automobile and Pollution- PaulDegobert(SAE)
2. Diesel engines operation manual- VL Maleev, CBS Publications.
3. IC Engines – E.F Obert, Harper and Row
4. Engine emission- Springer and Patterson, Plenum Press.
5. Heins Aeisth- Internal Combustion Engines- SAE Publications

IV Year B.Tech AE II SEM	L	T/P/D	C
Elective VI	3	0	3

(R11MED1153) PRINCIPLES OF ENTERPRENEURSHIP

THE ENTREPRENEURIAL PERSPECTIVE

UNIT I

The nature and importance of entrepreneurs

Sample profile; Nature and development of entrepreneurship; Definition of entrepreneurship; The entrepreneurial decision process - change from present lifestyle, desirability of new venture formation, and possibility of new venture formation; Types of start-ups; Role of entrepreneurship in economic development - government as an innovator, intrapreneurship, and entrepreneurship; Entrepreneurial careers and education; Ethics and social responsibility of entrepreneurs; The future of entrepreneurship.

The entrepreneurial and intrapreneurial mind

Sample profile; The entrepreneurial process - identify and evaluate the opportunity, develop a business plan, determine the resources required, and manage the enterprise; Managerial versus entrepreneurial decision making - strategic orientation, commitment to opportunity, commitment of resources, control of resources, and management structure; Causes for interest in intrapreneurship; Corporate versus intrapreneurial culture; Climate for intrapreneurship; Intrapreneurial leadership characteristics; Establishing intrapreneurship in the organization; Problems and successful efforts.

The individual entrepreneur

Sample profile; Entrepreneurial feelings - locus of control, feelings about independence and need for achievement, and risk taking; Entrepreneur background and characteristics - childhood family environment, education, personal values, age, and work history; Motivation; Role models and support systems - moral-support network, and professional-support network; Male versus female entrepreneurs; Minority entrepreneurship; Entrepreneurs versus inventors.

International entrepreneurship opportunities

Sample profile; The nature of international entrepreneurship; The importance of international business to the firm; International versus domestic entrepreneurship - economics, stage of economic development, balance of payments, type of system, political-legal environment, cultural environment, technological environment, and strategic issues; Entrepreneurial entry into international business - exporting, nonequity arrangements, and direct foreign investment; Barriers to international trade - general agreements on tariffs and trade, Increasing protectionist attitudes, Trade blocs and free trade areas; Entrepreneur's strategy and trade barriers, and entrepreneurial partnering; Case studies for “The entrepreneurial perspective”.

CREATING AND STARTING THE VENTURE

UNIT II

Creativity and the business idea

Sample profile; Sources of new ideas - consumers, existing products and services, distribution channels, federal government, and research and development; Methods of

generating ideas - focus groups, brainstorming, and problem inventory analysis; Creative problem solving - brainstorming, reverse brainstorming, brainwriting, Gordon method, checklist method, free association, forced relationships, collective notebook method, attribute listing, big-dream approach, and parameter analysis; Opportunity recognition; Product planning and development process - establishing evaluation criteria, idea stage, concept stage, product development stage, and test marketing stage; E-commerce and business start-up - using e-commerce creativity, website, tracking customer information, and doing e-commerce as an entrepreneurial company.

Legal issues for the entrepreneur

Sample profile; Intellectual property; Need for a lawyer; Select a lawyer; Legal issues in setting up the organization; Patents - international patents, the disclosure document, the patent application, and patent infringement; Business method patents; Trademarks - registering the trademark; Copyrights; Trade secrets; Licensing; Product safety and liability; Insurance; Contracts.

The business plan - creating and starting the venture

Sample profile; Planning as part of the business operation; Business plan; Writing the plan; Scope and value of the business plan—reading of the plan; evaluation of the plan by potential lenders and investors; Presenting the plan; Information needs - market information, operations information needs, and financial information needs; Using the internet as a resource tool; Writing the business plan - introductory page, executive summary, environmental and industry analyses, description of venture, production plan, operations plan, Marketing plan, organizational plan; assessment of risk, and financial plan; Using and implementing the business plan - measuring plan progress, and updating the plan; Failure of business plan.

UNIT III

The marketing plan

Sample profile; Industry analysis - competitor analysis; Marketing research for the new venture - defining the purpose or objectives, gathering data from secondary sources, gathering information from primary sources, analyzing and interpreting the results; Understanding the marketing plan; Characteristics of a marketing plan; The marketing mix; Steps in preparing the marketing plan - defining the business situation, defining the target market/opportunities and threats, considering strengths and weaknesses, establishing goals and objectives, defining marketing strategy and action programs, *marketing strategy*-consumer versus business-to-business markets, budgeting the marketing strategy, implementation of the market plan, and monitoring progress of marketing actions; Contingency planning; Failure of plans.

The organizational plan

Sample profile; Developing the management team; Legal forms of business - ownership, liability of owners, costs of starting a business, continuity of business, transferability of interest, capital requirements, management control, distribution of profits and losses, and attractiveness for raising capital; Tax attributes of forms of business - tax issues for proprietorship, tax issues for partnership, and tax issues for corporation;

(In the national and international context) The limited liability company versus the S corporation; S corporation - advantages and disadvantages of an S corporation; The limited liability company;

Designing the organization; Building the management team and a successful organization culture; The role of a board of directors; The board of advisors; The organization and use of advisors.

The financial plan

Sample profile; Operating and capital budgets; Pro Forma income statements; Pro Forma cash flow; Pro Forma balance sheet; Break-even analysis; Pro forma sources and applications of funds; software packages; Case studies for "creating and starting the venture".

UNIT IV

Financing the new venture: sources of capital

Sample profile; An overview - debt or equity financing, and internal or external funds; Personal funds; Family and friends; Commercial banks - types of bank loans, cash flow financing, and bank leading decisions; Role of SBA in small business financing; Research and development limited partnerships - major elements, procedure, benefits and costs, and case studies; Government grants – procedure; Private placement - types of investors, private offerings, and regulations; Bootstrap financing.

Informal risk capital and venture capital

Opening profile; Financing the business; Informal risk-capital market; Venture capital - nature of venture capital, overview of the venture-capital industry, venture-capital process, locating venture capitalists, and approaching a venture capitalist; Valuing your company - factors in valuation, ratio analysis, liquidity ratios, activity ratios, leverage ratios, profitability ratios, general valuation approaches, general valuation method, and evaluation of an internet company; Deal structure; Case studies for "financing the new venture".

MANAGING, GROWING, AND ENDING THE NEW VENTURE

UNIT V

Entrepreneurial strategy: generating and exploiting new entries

Sample profile; New entry; Generation of a new entry opportunity - resources as a source of competitive advantage, and creating an effective resource bundle; Assessing the attractiveness of a new entry opportunity - information on a new entry, comfort with making a decision under uncertainty, and decision to exploit or not to exploit the new entry; Entry strategy for new entry exploitation - environmental instability and first-mover (dis)advantages, customers' uncertainty and first-mover (dis)advantages, and lead time and first-mover (dis)advantages; Risk reduction strategies for new entry exploitation - market scope strategy, imitation strategies, and managing newness.

Strategies for growth and managing the implications of growth

Sample profile; Growth strategies - Avenues for growth opportunities - penetration strategies, market development strategies, product development strategies, diversification strategies, and case studies; Economic implications of growth; Implications of growth for the firm - pressures on existing financial resources, pressures on human resources, pressures on the management of employees, and pressures on the entrepreneur's time; Overcoming

pressures on existing financial resources; Financial control - managing cash flow, managing inventory, mananging fixed assets, managing costs and profits, taxes, and record keeping; Overcoming pressures on existing human resources; Overcoming pressures on the management of employees; Overcoming pressures on entrepreneurs' time - basic principles of time management; Implications of firm growth to the entrepreneur - a categorization of entrepreneurs and their firms' growth.

Accessing resources for growth from external sources

Sample profile; Using external parties to help grow a business; Franchising - advantages of franchising to the franchisee and the franchisor, disadvantages of franchising, and types of franchises; Investing in a franchise; Joint ventures - types of joint ventures, and factors in the joint venture success; Acquisitions - advantages of an acquisition, disadvantages of an acquisition, synergy, structuring the deal, locating acquisition candidates; Mergers; Leveraged buyouts; Overcoming constraints by negotiating for more resources.

Going public

Sample profile; Advantages and disadvantages of going public; The alternatives to going public; Timing of going public and underwriter selection - timing, and underwriter selection; Registration statement and timetable - the prospectus, and procedure; Legal issues, and blue-sky qualifications; After going public - aftermarket support, relationship with the financial community, and reporting requirements; myths concerning going public.

Ending the venture

Sample profile; Bankruptcy—an overview; Surviving bankruptcy; Prepackaged bankruptcy; Extended time payment plans; Liquidation; Strategy during reorganization; Keeping the venture going; Warning signs of bankruptcy; Starting over; The reality of failure; Business turnarounds; Exit strategy; Succession of business - transfer to family members and non–family members; Harvesting strategy - direct sale, employee stock option plan, and management buyout; case studies for "managing, growing and ending the new venture".

TEXT BOOK

Principles of Entrepreneurship *by* Robert D. Hisrich, Michael P. Peters, and Dean A. Shepherd; *Publisher: McGraw Hill.*

REFERENCE

1. Small Scale Industries and Entrepreneurship in the Twenty-First Century *by* Vasanth Desai; *Publisher: Himalaya Publishing House*.
2. Entrepreneurship: Successfully Launching New Ventures *by* Bruce R.Barringer and R. Duane Ireland; *Publisher: Pearson Education*.

IV Year B.Tech. AE II SEM	L	T/P/D	C
Elective VI	3	0	3

(R11MED1155) STATISTICAL QUALITY CONTROL AND TQM

UNIT I

Introduction and overview

The meaning of quality; The control-chart viewpoint; Scientific sampling; Use of examples; Meanings and usage of the words 'defective' and 'defect'; Significance of the viewpoint of statistical quality control; statistical quality control and useful by–products; Reasons for the use of the adjective, "statistical'; Four different levels of understanding statistical quality control; Nonmanufacturing applications of statistical quality control techniques;

Directions for sample x and r chart

Setting up and operating control charts for X and R; Checklist of necessary steps in using X and R charts; Some comments on computer software for statistical process control.

UNIT II

Why the control chart works; statistical concepts

The need for understanding statistical principles; Description of patterns of variation; Graphic representation of a frequency distribution; Averages and measures of dispersion; Sampling statistics and universe parameters; The normal curve; Other frequency curves; Interpretation of average and standard deviation of a set of numbers.

Why the control charts works; examples

The use of control charts to judge whether or not a constant system of chance causes is present; Use of the control chart in interpretation of a frequency distribution; Contribution of the control chart to elimination of causes of trouble; Changes in universe average; Shift in universe dispersion with no change in universe average; Change in universe average and universe dispersion; A possible view of the question answered by a control chart; Nonproduct applications of control charts for variables; Conflicting expressions for the standard deviation of a set of numbers.

UNIT III

Some fundamentals of the theory of probability

Probability and its mathematical meaning; Modern concepts of probability theory; Some theorems of the theory of probability; Infinite and finite universes; The hypergeometric probability distribution; The binomial as a probability distribution; The Poisson law as a probability distribution; The normal distribution; Deciding on the method to be used for calculating probabilities in industrial sampling problems; Relationship between control charts and certain other statistical techniques; Random variables; Point estimates and estimators; The problem of selecting a parameter to describe universe dispersion and of choosing an estimator for that parameter; Sampling from a normal distribution; Theory of extreme runs.

UNIT IV

The control chart for fraction rejected

Some practical limitations of control charts for variables; Control charts for attributes; Control charts for fraction rejected; The binomial as a probability law that determines the fluctuations of fraction rejected; Control limits for the *p* chart; Problems introduced by variable subgroup size; Checklist of necessary steps in connection with control chart for fraction rejected; Sensitivity of the *p* chart; Nonproduct applications of *p* and *np* charts; *p* charts are not suitable for all data on fraction rejected – why.

The control chart for nonconformities

The place of the *c* chart in statistical process control; Distinction between a nonconforming article and a nonconformity; Limits for the *c* chart are based on the Poisson distribution; The combination of Poisson distributions; Conditions favorable to the economic use of the control chart for nonconformities; Adaptations of the *c* chart to variations in the area of opportunity for a nonconformity; Probability limits for *c* and *u* charts; The *u* charts for nonconformities per multiple units.

UNIT V

TQM principles and practices

Definition; Basic approach; Gurus of TQM; TQM framework; Awareness; Defining quality; Historical reviews; Obstacles; Benefits of TQM; TQM exemplary organization.

Continuous process improvement

Intoduction; Process; The Juran Trilogy; Improvement strategies; Types of problems; The PDSA Cycle; Problem-solving method; Kaizen; Reengineering; Six-Sigma; TQM Exemplary Organization.

TEXT BOOK

Statistical Quality Control *by* Eugene Grant; *Publisher: McGraw Hill.*

REFERENCE

1. Total Quality Control *by* Armand V. Feigenbaum; *Publisher: McGraw Hill.*
2. Introduction to Statistical Quality Control *by* D.C.Montgomery; *Publisher: John Wiley.*

IV Year B.Tech. AE II SEM	L	T/P/D	C
Elective V	3	0	3

(R11MED1156) FRACTURE MECHANICS

UNIT I

Introduction; Historical perspective; Fracture mechanics approach to design – energy criterion, stress intensity approach, time-dependant crack growth and damage tolerance; Effect of material properties on fracture; Brief review of dimensional analysis.

UNIT II

Linear elastic fracture mechanics

An atomic view of fracture; Stress concentration effect of flaws; Griffith energy balance – comparison with critical stress criterion, and modified Griffith equation; Energy release rate; Instability and the R Curve – Reasons for the R curve shape, load control vs. displacement control, and structures with finite compliance; Stress analysis of cracks – stress intensity factor, relationship between K and global behavior, effect of finite size, principle of superposition, and weight functions; Relationship between K and G.

UNIT III

(Contd) **Linear elastic fracture mechanics**

Crack Tip Plasticity – The Irwin Approach, Strip-yield model, Comparison of plastic zone corrections, plastic zone shape; K controlled fracture; Plane Strain fracture – Crack-tip triaxiality, effect of thickness on apparent fracture toughness, plastic zone effects, implications for cracks in structures; Mixed Mode fracture – propagation of an angled crack, equivalent Mode I crack, and Biaxial loading; Interaction of multiple cracks – coplanar cracks, and parallel cracks.

UNIT IV

Elastic plastic fracture mechanics

Crack tip opening displacement; J contour integral – nonlinear energy release rate, J as a path independent line integral, J as a stress intensity parameter, large strain zone, and laboratory measurement of J; Relationships between J and CTOD; Crack-growth resistance curves – stable and unstable crack growth, and computation of J for a growing crack; J controlled fracture – stationary cracks, and J controlled crack growth; Crack-tip constraint under large scale yielding – elastic T stress, and J-Q theory.

UNIT V

Dynamic and time dependent fracture

Dynamic fracture and crack arrest - rapid loading of a stationary crack; Rapid crack propagation and crack arrest – crack speed, elastodynamic crack tip parameters, dynamic toughness, and crack arrest; Dynamic contour integrals.

TEXT BOOK

Fracture Mechanics: Introduction and Applications *by* T.L. Anderson; *Publisher: CRC Press.*