

# ANNA UNIVERSITY, CHENNAI

## AFFILIATED INSTITUTIONS

### R - 2008

#### B.E. AUTOMOBILE ENGINEERING

#### II TO VIII SEMESTERS CURRICULUM AND SYLLABI

#### SEMESTER II

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	HS2161	<a href="#">Technical English – II*</a>	3	1	0	4
2.	MA2161	<a href="#">Mathematics – II*</a>	3	1	0	4
3.	PH2161	<a href="#">Engineering Physics – II*</a>	3	0	0	3
4.	CY2161	<a href="#">Engineering Chemistry – II*</a>	3	0	0	3
5. a	ME2151	<a href="#">Engineering Mechanics</a> <b>(For non-circuit branches)</b>	3	1	0	4
5. b	EE2151	<a href="#">Circuit Theory</a> <b>(For branches under Electrical Faculty)</b>	3	1	0	4
5. c	EC2151	<a href="#">Electric Circuits and Electron Devices</a> <b>(For branches under I &amp; C Faculty)</b>	3	1	0	4
6. a	GE2151	<a href="#">Basic Electrical &amp; Electronics Engineering</a> <b>(For non-circuit branches)</b>	4	0	0	4
6. b	GE2152	<a href="#">Basic Civil &amp; Mechanical Engineering</a> <b>(For circuit branches)</b>	4	0	0	4
<b>PRACTICAL</b>						
7.	GE2155	<a href="#">Computer Practice Laboratory-II*</a>	0	1	2	2
8.	GS2165	<a href="#">Physics &amp; Chemistry Laboratory - II*</a>	0	0	3	2

9. a	ME2155	<a href="#">Computer Aided Drafting and Modeling Laboratory</a> (For non-circuits branches)	0	1	2	2
9. b	EE2155	<a href="#">Electrical Circuits Laboratory</a> (For branches under Electrical Faculty)	0	0	3	2
9. c	EC2155	<a href="#">Circuits and Devices Laboratory</a> (For branches under I & C Faculty)	0	0	3	2
<b>TOTAL : 28 CREDITS</b>						
10.	-	<a href="#">English Language Laboratory</a> <sup>+</sup>	0	0	2	-

\* Common to all B.E. / B.Tech. Programmes

+ Offering English Language Laboratory as an additional subject (with no marks) during 2<sup>nd</sup> semester may be decided by the respective Colleges affiliated to Anna University Chennai.

### **A. CIRCUIT BRANCHES**

#### **I Faculty of Electrical Engineering**

1. B.E. Electrical and Electronics Engineering
2. B.E. Electronics and Instrumentation Engineering
3. B.E. Instrumentation and Control Engineering

#### **II Faculty of Information and Communication Engineering**

1. B.E. Computer Science and Engineering
2. B.E. Electronics and Communication Engineering
3. B.E. Bio Medical Engineering
4. B.Tech. Information Technology

### **B. NON – CIRCUIT BRANCHES**

#### **I Faculty of Civil Engineering**

1. B.E. Civil Engineering

#### **II Faculty of Mechanical Engineering**

1. B.E. Aeronautical Engineering
2. B.E. Automobile Engineering

3. B.E. Marine Engineering
4. B.E. Mechanical Engineering
5. B.E. Production Engineering

### III Faculty of Technology

1. B.Tech. Chemical Engineering
2. B.Tech. Biotechnology
3. B.Tech. Polymer Technology
4. B.Tech. Textile Technology
5. B.Tech. Textile Technology (Fashion Technology)
6. B.Tech. Petroleum Engineering
7. B.Tech. Plastics Technology

### SEMESTER – III

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
MA 2211	<a href="#">Transforms And Partial Differential Equations</a>	3	1	0	4
AT 2203	<a href="#">Engineering Thermodynamics</a>	3	1	0	4
ME 2204	<a href="#">Fluid Mechanics and Machinery</a>	3	1	0	4
AT 2201	<a href="#">Automotive Engines</a>	3	0	0	3
AE 2201	<a href="#">Mechanics of Machines</a>	3	1	0	4
<b>AE 2253</b>	<a href="#">Production Technology</a>	3	0	0	3
<b>PRACTICAL</b>					
AT 2205	<a href="#">Automotive Components Laboratory</a>	0	0	3	2
AT 2207	<a href="#">Fluid Mechanics and Machinery Laboratory</a>	0	0	3	2
AT 2206	<a href="#">Manufacturing Technology Laboratory</a>	0	0	3	2
<b>TOTAL</b>		<b>18</b>	<b>4</b>	<b>9</b>	<b>28</b>

### SEMESTER – IV

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
MA 2266	<a href="#">Statistics And Numerical Methods</a>	3	1	0	4
AT 2251	<a href="#">Applied Thermodynamics and Heat Transfer</a>	3	1	0	4
ME 2253	<a href="#">Engineering Materials and Metallurgy</a>	3	0	0	3
ME 2254	<a href="#">Strength of Materials</a>	3	1	0	4
<b>ME 2255</b>	<a href="#">Electronics and Microprocessors</a>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
AT 2252	<a href="#">Automotive Chassis</a>	3	0	0	3
<b>PRACTICAL</b>					
AT 2255	<a href="#">Engine Performance and Emission Testing Laboratory</a>	0	0	3	2
AT 2256	<a href="#">Computer Aided Machine Drawing Laboratory</a>	0	0	3	2

AT 2257	<a href="#">Electronics and Micro-processors Laboratory</a>	0	0	3	2
ME 2256	<a href="#">Strength of Materials Lab</a>	0	0	3	2
<b>TOTAL</b>		<b>18</b>	<b>3</b>	<b>12</b>	<b>29</b>

### SEMESTER V

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

CODE NO	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
GE2021	<a href="#">Environmental Science and Engineering</a>	3	0	0	3
ME2303	<a href="#">Design of Machine Elements</a>	3	1	0	4
AT2301	<a href="#">Automotive Transmission</a>	3	1	0	4
AT2302	<a href="#">Automotive Electrical and Electronics</a>	3	0	0	3
AT2303	<a href="#">Vehicle Design and Data Characteristics</a>	3	1	0	4
AT2305	<a href="#">Automotive Fuels and Lubricants</a>	3	0	0	3
<b>PRACTICAL</b>					
GE2321	<a href="#">Communication Skills Laboratory</a>	0	0	4	2
AT2307	<a href="#">Automotive Electrical and Electronics Laboratory</a>	0	0	3	2
AT2308	<a href="#">Automotive Fuels and Lubricants Laboratory</a>	0	0	3	2
<b>TOTAL</b>		<b>18</b>	<b>3</b>	<b>10</b>	<b>27</b>

### SEMESTER – VI

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
MG2351	<a href="#">Principles of Management</a>	3	0	0	3
AT2351	<a href="#">Automotive Engine Components Design</a>	3	1	0	4
AT2352	<a href="#">Automotive Chassis Components Design</a>	3	1	0	4
AT2353	<a href="#">Two and Three Wheelers</a>	3	0	0	3
ME2353	<a href="#">Finite Element Analysis</a>	3	1	0	4
	<a href="#">Elective I</a>	3	0	0	3
<b>PRACTICAL</b>					
AT2354	<a href="#">Computer Aided Engine Design Laboratory</a>	0	0	3	2
AT2355	<a href="#">Computer Aided Chassis Design Laboratory</a>	0	0	3	2
AT2356	<a href="#">Two and Three Wheelers Laboratory</a>	0	0	3	2
<b>TOTAL</b>		<b>18</b>	<b>3</b>	<b>9</b>	<b>27</b>

### SEMESTER – VII

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
AT2401	<a href="#">Engine and Vehicle Management System</a>	4	0	0	4
AT2402	<a href="#">Vehicle Dynamics</a>	3	1	0	4
AT2403	<a href="#">Vehicle Maintenance</a>	3	0	0	3
AT2404	<a href="#">Automotive Pollution and Control</a>	3	0	0	3
	<a href="#">Elective-II</a>	3	0	0	3
	<a href="#">Elective-III</a>	3	0	0	3
<b>PRACTICAL</b>					
AT2405	<a href="#">Vehicle Maintenance and Re-conditioning Laboratory</a>	0	0	3	2
ME2309	<a href="#">CAD and CAM Laboratory</a>	0	0	3	2
	<b>TOTAL</b>	<b>19</b>	<b>1</b>	<b>6</b>	<b>24</b>

### SEMESTER – VIII

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
AT2451	<a href="#">Vehicle Body Engineering</a>	3	0	0	3
	<a href="#">Elective-IV</a>	3	0	0	3
	<a href="#">Elective-V</a>	3	0	0	3
<b>PRATICAL</b>					
AT2452	<a href="#">Comprehension</a>	0	0	2	1
AT2453	<a href="#">Project Work</a>	0	0	12	6
	<b>TOTAL</b>	<b>9</b>	<b>0</b>	<b>14</b>	<b>16</b>

### SEMESTER - VI

#### ELECTIVE I

CODE NO.	COURSE TITLE	L	T	P	C
GE2025	<a href="#">Professional Ethics In Engineering</a>	3	0	0	3
AT2021	<a href="#">Automotive Air-conditioning</a>	3	0	0	3
AT2022	<a href="#">Alternate Fuels and Energy Systems</a>	3	0	0	3
AT2023	<a href="#">Vibration , Noise and Harshness Control</a>	3	0	0	3
AT2024	<a href="#">Advanced Theory of I.C. Engines</a>	3	0	0	3
ME2021	<a href="#">Quality Control and Reliability Engineering</a>	3	0	0	3
AT2037	<a href="#">Metrology and Instrumentation</a>	3	0	0	3

**SEMESTER - VII****ELECTIVE II**

<b>CODE NO.</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
ME2030	<a href="#">Composite Materials</a>	3	0	0	3
ME 2029	<a href="#">Design of Jigs, Fixtures and Press Tools</a>	3	0	0	3
ME2028	<a href="#">Robotics</a>	3	0	0	3
AT2029	<a href="#">New Generation and Hybrid Vehicles</a>	3	0	0	3
AT2028	<a href="#">Computer Simulation of I.C. Engines</a>	3	0	0	3

**ELECTIVE III**

<b>CODE NO.</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
AT2026	<a href="#">Supercharging And Scavenging</a>	3	0	0	3
AT2027	<a href="#">Automotive Aero-dynamics</a>	3	0	0	3
AT2030	<a href="#">Off Road Vehicles</a>	3	0	0	3
AT2031	<a href="#">Project and Materials Management</a>	3	0	0	3
AT2032	<a href="#">Engine Auxiliary Systems</a>	3	0	0	3

**SEMESTER - VIII****ELECTIVE IV**

<b>CODE NO.</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
MG2021	<a href="#">Marketing Management</a>	3	0	0	3
ME2035	<a href="#">Entrepreneurship Development</a>	3	0	0	3
ME2038	<a href="#">Operations Research</a>	3	0	0	3
GE2022	<a href="#">Total Quality Management</a>	3	0	0	3

**ELECTIVE V**

<b>CODE NO.</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
AT2033	<a href="#">Automotive Safety</a>	3	0	0	3
AT2034	<a href="#">Fuel Cell Technology</a>	3	0	0	3
AT2035	<a href="#">Transport Management</a>	3	0	0	3

**AIM:**

To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

**OBJECTIVES:**

- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.
- To help students improve their active and passive vocabulary.
- To familiarize students with different rhetorical functions of scientific English.
- To enable students write letters and reports effectively in formal and business situations.

**UNIT I****12**

Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading& predicting content, Reading and interpretation, extended definitions, Process description

**Suggested activities:**

1. Exercises on word formation using the prefix 'self' - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings
4. and predicting the content – Reading advertisements and interpretation.
5. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

**UNIT II****12**

Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

**Suggested activities:**

1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

**UNIT III****12**

Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations .

**Suggested activities:**

1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. ( Eg: object –verb / object – noun )
2. Speaking exercises involving the use of stress and intonation – Group discussions– analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.
4. Sequencing of jumbled sentences using connectives – Writing different types of reports like industrial accident report and survey report – Writing recommendations.

**UNIT IV****12**

Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

**Suggested Activities:**

1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – Writing argumentative paragraphs – Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

**UNIT V****9**

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

**Suggested Activities:**

1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

**TOTAL: 60 PERIODS****TEXT BOOK:**

1. Chapters 5 – 8. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 5 – 8 (Technology, Communication, Environment, Industry)

**REFERENCES:**

1. P. K. Dutt, G. Rajeevan and C.L.N Prakash, 'A Course in Communication Skills', Cambridge University Press, India 2007.
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd., (Reprinted 1994 – 2007).
3. Edgar Thorpe, Showick Thorpe, 'Objective English', Second Edition, Pearson Education, 2007.

**EXTENSIVE READING:**

1. Robin Sharma, 'The Monk Who Sold His Ferrari', Jaico Publishing House, 2007

**NOTE:**

The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

**MA2161****MATHEMATICS – II**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**UNIT I ORDINARY DIFFERENTIAL EQUATIONS****12**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

**UNIT II VECTOR CALCULUS****12**

Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

**UNIT III ANALYTIC FUNCTIONS****12**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping :  $w = z+c$ ,  $cz$ ,  $1/z$ , and bilinear transformation.

**UNIT IV COMPLEX INTEGRATION****12**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

**UNIT V LAPLACE TRANSFORM****12**

Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions.

Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

**TOTAL: 60 PERIODS****TEXT BOOK:**

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", 3<sup>rd</sup> Edition, Laxmi Publications (p) Ltd., (2008).

- Grewal. B.S, "Higher Engineering Mathematics", 40<sup>th</sup> Edition, Khanna Publications, Delhi, (2007).

**REFERENCES:**

- Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2007).
- Glyn James, "Advanced Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, (2007).
- Erwin Kreyszig, "Advanced Engineering Mathematics", 7<sup>th</sup> Edition, Wiley India, (2007).
- Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3<sup>rd</sup> Edition, Narosa Publishing House Pvt. Ltd., (2007).

**PH2161**

**ENGINEERING PHYSICS – II**

**L T P C**  
**3 0 0 3**

**UNIT I CONDUCTING MATERIALS**

**9**

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

**UNIT II SEMICONDUCTING MATERIALS**

**9**

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration – compound semiconductors – Hall effect – Determination of Hall coefficient – Applications.

**UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS**

**9**

Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications – magnetic recording and readout – storage of magnetic data – tapes, floppy and magnetic disc drives.  
Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High T<sub>c</sub> superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

**UNIT IV DIELECTRIC MATERIALS**

**9**

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

## UNIT V MODERN ENGINEERING MATERIALS

9

Metallic glasses: preparation, properties and applications.

Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA

Nanomaterials: synthesis –plasma arcing – chemical vapour deposition – sol-gels – electrodeposition – ball milling - properties of nanoparticles and applications.

Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour deposition - structure – properties and applications.

**TOTAL: 45 PERIODS**

### TEXT BOOKS:

1. Charles Kittel ‘ Introduction to Solid State Physics’, John Wiley & sons, 7<sup>th</sup> edition, Singapore (2007)
2. Charles P. Poole and Frank J.Owren, ‘Introduction to Nanotechnology’, Wiley India(2007) (for Unit V)

### REFERENCES:

1. Rajendran, V, and Marikani A, ‘Materials science’Tata McGraw Hill publications, (2004) New delhi.
2. Jayakumar, S. ‘Materials science’, R.K. Publishers, Coimbatore, (2008).
3. Palanisamy P.K, ‘Materials science’, Scitech publications(India) Pvt. LTd., Chennai, second Edition(2007)
4. M. Arumugam, ‘Materials Science’ Anuradha publications, Kumbakonam, (2006).

**CY2161**

**ENGINEERING CHEMISTRY – II**

**L T P C**  
**3 0 0 3**

### AIM

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

### OBJECTIVES

- The student should be conversant with the principles electrochemistry, electrochemical cells, emf and applications of emf measurements.
- Principles of corrosion control
- Chemistry of Fuels and combustion
- Industrial importance of Phase rule and alloys
- Analytical techniques and their importance.

## UNIT I ELECTROCHEMISTRY

9

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox -  $\text{Fe}^{2+}$  vs dichromate and precipitation –  $\text{Ag}^+$  vs  $\text{Cl}^-$  titrations) and conduct metric titrations (acid-base – HCl vs, NaOH) titrations,

**UNIT II CORROSION AND CORROSION CONTROL 9**

Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating.

**UNIT III FUELS AND COMBUSTION 9**

Calorific value – classification – Coal – proximate and ultimate analysis metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and fractions – cracking – catalytic cracking and methods-knocking – octane number and cetane number – synthetic petrol – Fischer Tropsch and Bergius processes – Gaseous fuels-water gas, producer gas, CNG and LPG, Flue gas analysis – Orsat apparatus – theoretical air for combustion.

**UNIT IV PHASE RULE AND ALLOYS 9**

Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead-silver system only) – alloys – importance, ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

**UNIT V ANALYTICAL TECHNIQUES 9**

Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (problem) (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).

**REFERENCES:**

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).

**OBJECTIVE**

At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

**UNIT I BASICS & STATICS OF PARTICLES****12**

Introduction – Units and Dimensions – Laws of Mechanics – Lamé's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

**UNIT II EQUILIBRIUM OF RIGID BODIES****12**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

**UNIT III PROPERTIES OF SURFACES AND SOLIDS****12**

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

**UNIT IV DYNAMICS OF PARTICLES****12**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

**UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS****12**

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction.

Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

**TOTAL: 60 PERIODS**

**TEXT BOOK:**

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

**REFERENCES:**

1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2000).
2. Hibbeler, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3. Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw-Hill, (2001).
4. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd., (2003).
5. Ashok Gupta, "Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., (2002).

**EE2151**

**CIRCUIT THEORY**

(Common to EEE, EIE and ICE Branches)

**L T P C**

**3 1 0 4**

**UNIT I BASIC CIRCUITS ANALYSIS**

**12**

Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

**UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS**

**12**

Network reduction: voltage and current division, source transformation – star delta conversion.

Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

**UNIT III RESONANCE AND COUPLED CIRCUITS**

**12**

Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

**UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS**

**12**

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

**UNIT V ANALYSING THREE PHASE CIRCUITS**

**12**

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6<sup>th</sup> edition, New Delhi, (2002).
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, (2007).

**REFERENCES:**

1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi (2001).
3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
4. Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003).

<b>EC2151</b>	<b>ELECTRIC CIRCUITS AND ELECTRON DEVICES</b>	<b>L T P C</b>
	(For ECE, CSE, IT and Biomedical Engg. Branches)	<b>3 1 0 4</b>

**UNIT I CIRCUIT ANALYSIS TECHNIQUES 12**

Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

**UNIT II TRANSIENT RESONANCE IN RLC CIRCUITS 12**

Basic RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor – single tuned and double tuned circuits.

**UNIT III SEMICONDUCTOR DIODES 12**

Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode – Energy band structure – current equation – space charge and diffusion capacitances – effect of temperature and breakdown mechanism – Zener diode and its characteristics.

**UNIT IV TRANSISTORS 12**

Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET.

**UNIT V SPECIAL SEMICONDUCTOR DEVICES (Qualitative Treatment only) 12**

Tunnel diodes – PIN diode, varactor diode – SCR characteristics and two transistor equivalent model – UJT – Diac and Triac – Laser, CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LED, LCD.

**TOTAL: 60 PERIODS****TEXT BOOKS:**

1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum series, Tata McGraw Hill, (2001)
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits", Tata McGraw Hill, 2<sup>nd</sup> Edition, (2008).
3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5<sup>th</sup> Edition, (2008).

**REFERENCES:**

1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, 7<sup>th</sup> Edition, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and Steven M. Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 6<sup>th</sup> Edition, 2002.
3. J. Millman & Halkins, Satyabranta Jit, "Electronic Devices & Circuits", Tata McGraw Hill, 2<sup>nd</sup> Edition, 2008.

**GE2151 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C**  
(Common to branches under Civil, Mechanical and Technology faculty) **4 0 0 4****UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS 12**

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

**UNIT II ELECTRICAL MECHANICS 12**

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

**UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12**

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

**UNIT IV DIGITAL ELECTRONICS 12**

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

**UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 12**  
Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. V.N. Mittle “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
2. R.S. Sedha, “Applied Electronics” S. Chand & Co., 2006.

**REFERENCES:**

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press (2005).
3. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, (1994).
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, (2002).
5. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers, (2003).

**GE2152 BASIC CIVIL & MECHANICAL ENGINEERING L T P C**  
(Common to branches under Electrical and I & C Faculty) **4 0 0 4**

**A – CIVIL ENGINEERING**

**UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 15**

**Surveying:** Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

**Civil Engineering Materials:** Bricks – stones – sand – cement – concrete – steel sections.

**UNIT II BUILDING COMPONENTS AND STRUCTURES 15**

**Foundations:** Types, Bearing capacity – Requirement of good foundations.

**Superstructure:** Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

**TOTAL: 30 PERIODS**

**B – MECHANICAL ENGINEERING**

**UNIT III POWER PLANT ENGINEERING 10**

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines –

working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

**UNIT IV I C ENGINES** **10**

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

**UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM** **10**

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

**TOTAL: 30 PERIODS**

**REFERENCES:**

1. Shanmugam G and Palanichamy M S, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co., New Delhi, (1996).
2. Ramamrutham. S, “Basic Civil Engineering”, Dhanpat Rai Publishing Co. (P) Ltd. (1999).
3. Seetharaman S. “Basic Civil Engineering”, Anuradha Agencies, (2005).
4. Venugopal K and Prahu Raja V, “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam, (2000).
5. Shantha Kumar S R J., “Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, (2000).

**GE2155** **COMPUTER PRACTICE LABORATORY – II** **L T P C**  
**0 1 2 2**

**LIST OF EXPERIMENTS**

- |   |           |
|---|-----------|
| <b>1. UNIX COMMANDS</b>   | <b>15</b> |
| Study of Unix OS - Basic Shell Commands - Unix Editor             |           |
| <b>2. SHELL PROGRAMMING</b>                                       | <b>15</b> |
| Simple Shell program - Conditional Statements - Testing and Loops |           |
| <b>3. C PROGRAMMING ON UNIX</b>                                   | <b>15</b> |
| Dynamic Storage Allocation-Pointers-Functions-File Handling       |           |

**TOTAL: 45 PERIODS**

**HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS**

**Hardware**

- . 1 UNIX Clone Server
- . 33 Nodes (thin client or PCs)
- . Printer – 3 Nos.

**Software**

- . OS – UNIX Clone (33 user license or License free Linux)
- . Compiler - C

**GS2165**

**PHYSICS LABORATORY – II**

**L T P C**  
**0 0 3 2**

**LIST OF EXPERIMENTS**

1. Determination of Young's modulus of the material – non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
4. Determination of viscosity of liquid – Poiseuille's method.
5. Spectrometer dispersive power of a prism.
6. Determination of Young's modulus of the material – uniform bending.
7. Torsional pendulum – Determination of rigidity modulus.

- **A minimum of FIVE experiments shall be offered.**
- **Laboratory classes on alternate weeks for Physics and Chemistry.**
- **The lab examinations will be held only in the second semester.**

**GS2165**

**CHEMISTRY LABORATORY – II**

**L T P C**  
**0 0 3 2**

**LIST OF EXPERIMENTS**

1. Conduct metric titration (Simple acid base)
2. Conduct metric titration (Mixture of weak and strong acids)
3. Conduct metric titration using  $\text{BaCl}_2$  vs  $\text{Na}_2\text{SO}_4$
4. Potentiometric Titration ( $\text{Fe}^{2+}$  /  $\text{KMnO}_4$  or  $\text{K}_2\text{Cr}_2\text{O}_7$ )
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper sulphate)
7. Estimation of Ferric iron by spectrophotometry.

- **A minimum of FIVE experiments shall be offered.**

- **Laboratory classes on alternate weeks for Physics and Chemistry.**
- **The lab examinations will be held only in the second semester.**

**ME2155 COMPUTER AIDED DRAFTING AND MODELING LABORATORY**    **L T P C**  
**0 1 2 2**

**List of Exercises using software capable of Drafting and Modeling**

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building ( Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

**Note: Plotting of drawings must be made for each exercise and attached to the records written by students.**

**List of Equipments for a batch of 30 students:**

1. Pentium IV computer or better hardware, with suitable graphics facility -30 No.
2. Licensed software for Drafting and Modeling. – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings – 2 No.

**TOTAL: 45 PERIODS**

**EE2155**

**ELECTRICAL CIRCUIT LABORATORY**  
(Common to EEE, EIE and ICE)

**L T P C**  
**0 0 3 2**

**LIST OF EXPERIMENTS**

1. Verification of ohm's laws and kirchoff's laws.
2. Verification of Thevemin's and Norton's Theorem
3. Verification of superposition Theorem
4. Verification of maximum power transfer theorem.
5. Verification of reciprocity theorem
6. Measurement of self inductance of a coil
7. Verification of mesh and nodal analysis.
8. Transient response of RL and RC circuits for DC input.
9. Frequency response of series and parallel resonance circuits.
10. Frequency response of single tuned coupled circuits.

**TOTAL: 45 PERIODS**

**EC2155**

**CIRCUITS AND DEVICES LABORATORY**

**L T P C**  
**0 0 3 2**

1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems.
3. Verification of superposition Theorem.
4. Verification of Maximum power transfer and reciprocity theorems.
5. Frequency response of series and parallel resonance circuits.
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET
11. Characteristics of Diac and Triac.
12. Characteristics of Photodiode and Phototransistor.

**TOTAL: 45 PERIODS**

## ENGLISH LANGUAGE LABORATORY (Optional)

L T P C  
0 0 2 -

**1. Listening:** 5  
Listening & answering questions – gap filling – Listening and Note taking- Listening to telephone conversations

**2. Speaking:** 5  
Pronouncing words & sentences correctly – word stress – Conversation practice.

**Classroom Session** 20

1. Speaking: Introducing oneself, Introducing others, Role play, Debate- Presentations: Body language, gestures, postures. Group Discussions etc
2. Goal setting – interviews – stress time management – situational reasons

### Evaluation

(1) Lab Session – 40 marks

- Listening – 10 marks
- Speaking – 10 marks
- Reading – 10 marks
- Writing – 10 marks

(2) Classroom Session – 60 marks

- Role play activities giving real life context – 30 marks
- Presentation – 30 marks

### Note on Evaluation

1. Examples for role play situations:
  - a. Marketing engineer convincing a customer to buy his product.
  - b. Telephone conversation – Fixing an official appointment / Enquiry on availability of flight or train tickets / placing an order. etc.
2. Presentations could be just a Minute (JAM activity) or an Extempore on simple topics or visuals could be provided and students could be asked to talk about it.

### REFERENCES:

1. Hartley, Peter, Group Communication, London: Routledge, (2004).
2. Doff, Adrian and Christopher Jones, Language in Use – (Intermediate level), Cambridge University Press, (1994).
3. Gammidge, Mick, Speaking Extra – A resource book of multi-level skills activities , Cambridge University Press, (2004).
4. Craven, Miles, Listening Extra - A resource book of multi-level skills activities, Cambridge, Cambridge University Press, (2004).
5. Naterop, Jean & Rod Revell, Telephoning in English, Cambridge University Press, (1987).

### LAB REQUIREMENTS

1. Teacher – Console and systems for students

2. English Language Lab Software
3. Tape Recorders.

**MA2211 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS** **L T P C**  
**(Common to all branches)** **3 1 0 4**

**OBJECTIVE**

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

**UNIT I FOURIER SERIES** **9 + 3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

**UNIT II FOURIER TRANSFORMS** **9 + 3**

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT III PARTIAL DIFFERENTIAL EQUATIONS** **9 + 3**

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

**UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS** **9 + 3**

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

**UNIT V Z -TRANSFORMS AND DIFFERENCE EQUATIONS** **9 + 3**

Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem - Formation of difference equations – Solution of difference equations using Z-transform.

**LECTURES: 45 TUTORIALS: 15 TOTAL: 60 PERIODS**

**TEXT BOOKS**

1. Grewal, B.S, 'Higher Engineering Mathematics' 40<sup>th</sup> Edition, Khanna publishers, Delhi, (2007)

**REFERENCES**

1. Bali.N.P and Manish Goyal 'A Textbook of Engineering Mathematics', Seventh Edition, Laxmi Publications(P) Ltd. (2007)
2. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).
3. Glyn James, 'Advanced Modern Engineering Mathematics', Third edition-Pearson Education (2007).

4. Erwin Kreyszig 'Advanced Engineering Mathematics', Eighth edition-Wiley India (2007).

**AT2203**

**ENGINEERING THERMODYNAMICS**

**L T P C**  
**3 1 0 4**

**OBJECTIVE**

- To achieve an understanding of principles of thermodynamics and to be able to use it in accounting for the bulk behaviour of the simple physical systems.
- To provide in-depth study of thermodynamic principles, thermodynamics of state, basic thermodynamic relations, Principle of Psychrometry & Properties of pure substances
- To enlighten the basic concepts of vapour power cycles.

**UNIT I BASIC CONCEPT AND FIRST LAW**

**9+3**

Basic concepts - concept of continuum, macroscopic approach, thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

**UNIT II SECOND LAW, ENTROPY AND AVAILABILITY**

**9+3**

Second law of thermodynamics – Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot cycle, reversed carnot cycle, efficiency, COP. Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy – Carnot theorem, absolute entropy, availability

**UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE**

**9+3**

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in non-flow and flow processes. Standard Rankine cycle, Reheat and regenerative cycle.

**UNIT IV IDEAL & REAL GASES AND THERMO DYNAMIC RELATIONS**

**9+3**

Gas mixtures – Properties of ideal and real gases, equation of state, Avagadro's law, Vander Waal's equation of states, compressibility, compressibility chart. Dalton's law of partial pressure, Exact differentials, T-D, relations, Maxwell relations, Clausius Clapeyron equations, Joule Thomson Coefficient.

**UNIT V PSYCHROMETRY**

**9+3**

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling, problems.

**TUTORIALS 15 TOTAL: 60 PERIODS**



**UNIT IV ROTO DYNAMIC MACHINES** **16**  
 Homologous units. Specific speed. Elementary cascade theory. Theory of turbo machines. Euler's equation. Hydraulic efficiency. Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines. Centrifugal pumps, turbines, performance curves for pumps and turbines.

**UNIT V POSITIVE DISPLACEMENT MACHINES** **11**  
 Reciprocating pumps, Indicator diagrams, Work saved by air vessels. Rotary pumps. Classification. Working and performance curves.

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

**REFERENCES:**

1. Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi, 1988.
2. Kumar. K.L., Engineering Fluid Mechanics (VII Ed.) Eurasia Publishing House (P) Ltd., New Delhi, 1995.
3. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi

<b>AT2201</b>	<b>AUTOMOTIVE ENGINES</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVE**

To understand the basic principles of engines used for automobiles and different systems.

**UNIT I CONSTRUCTION AND OPERATION** **9**

Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines – construction and working. Comparison of SI and CI engines and four stroke and two stroke engines. Engine classification, firing order. Otto, diesel and dual cycles.

...  
**UNIT II FUEL SYSTEMS** **9**

Air fuel ratio requirements of SI engines, Air fuel ratio and emissions, Working of a simple fixed venturi carburetor, Constant vacuum carburetor. Diesel fuel injection systems-Jerk pumps, distributor pumps, pintle and multihole nozzles, Unit injector and common rail injection systems. Injection pump calibration. Need for a governor for diesel engines. Description of a simple diesel engine governor.

**UNIT III COMBUSTION AND COMBUSTION CHAMBERS 9**

Introduction to combustion in SI and diesel engines and stages of combustion. Dependence of ignition timing on load and speed. Knock in SI and CI engines. Combustion chambers for SI and CI engines. Direct and indirect injection combustion chambers for CI engines. Importance of Swirl, squish and turbulence. Factors controlling combustion chamber design.

**UNIT IV SUPERCHARGING , TURBOCHARGING AND ENGINE TESTING 9**

Supercharging and Turbocharging, Different methods of turbocharging, Intercooling, Turbocharger controls including, waster gate, variable geometry, variable nozzle types. Dynamometers, Indicated thermal, brake thermal and volumetric efficiencies. Measurement of friction, Cylinder pressure measurement. Engine performance maps, Engine testing standards.

**UNIT V COOLING AND LUBRICATION SYSTEMS 9**

Need for cooling, types of cooling systems- air and liquid cooling systems. Thermo syphon and forced circulation and pressurized cooling systems. Properties of coolants. Requirements of lubrication systems. Types-mist, pressure feed, dry and wet sump systems. Properties of lubricants.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Internal Combustion Engines by V. Ganesan, 2007, Tata Mc Graw Hill
2. Ramalingam K.K., "Internal Combustion Engines", Sci-Tech Publications, 2005.

**REFERENCES**

1. Advanced Engine Technology by Heisler, SAE Publication
2. Edward F. Obert Internal Combustion Engines
- 3 H.N. Gupta Fundamentals of Internal Combustion Engines by, PHI
- 4 .Mathur and Sharma Intendamental Combustion Engines Dhanpat Rai and Sons 2002
- 5 John B. Heywood, "Fundamentals of Internal Combustion Engines",

**AE2201 MECHANICS OF MACHINES L T P C**  
(Common to Production, Automobile and Aero) **3 1 0 4**

**OBJECTIVE**

To expose the students the different mechanisms, their method of working, Forces involved and consequent vibration during working

**UNIT I MECHANISMS 9+3**

Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom - Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.

**UNIT II FRICTION****9+3**

Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

**UNIT III GEARING AND CAMS****9+3**

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicyclic gear trains - Determination of speed and torque- Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions

**UNIT IV BALANCING****9+3**

Static and dynamic balancing – Single and several masses in different planes – Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method

**UNIT V VIBRATION****9+3**

Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi rotor systems – Geared shafts – Critical speed of shaft.

**TOTAL: 60 PERIODS****TEXT BOOKS**

1. Rattan.S.S, "Theory of Machines", Tata McGraw–Hill Publishing Co., New Delhi,2004
2. Ballaney.P.L, "Theory of Machines", Khanna Publishers, New Delhi, 2002.

**REFERENCES**

1. Rao,J.S and Dukkipati, R.V, "Mechanism and Machine Theory", Second Edition, Wiley Eastern Ltd., 2002.
2. Malhotra, D.R and Gupta, H.C., "The Theory of Machines", Satya Prakasam, Tech. India Publications, 2005.
3. Gosh, A. and Mallick, A.K., "Theory of Machines and Mechanisms", Affiliated East West Press, 2006.

**AE2253**

**PRODUCTION TECHNOLOGY**  
**(Common to Aeronautical & Automobile)**

**L T P C**  
**3 0 0 3****OBJECTIVE**

The automobile components such as piston, connecting rod, crankshaft, engine block, front axle, frame, body etc., are manufactured by various types of production processes involving casting, welding, machining, metal forming, power metallurgy etc. Hence B.E. Automobile Engineering students must study this course Production Technology.

**UNIT I CASTING****8**

Casting types, procedure to make sand mould, types of core making, moulding tolls, machine moulding, special moulding processes – CO<sub>2</sub> moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

**UNIT II WELDING****8**

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

**UNIT III MACHINING****13**

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines.

General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

**UNIT IV FORMING AND SHAPING OF PLASTICS****7**

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods

**UNIT V METAL FORMING AND POWDER METALLURGY****9**

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
2. Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice-Hall of India Private Limited, 2007.

**REFERENCES**

1. Serope Kalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", 4/e, Pearson Education, Inc. 2007.
2. R.K.Jain and S.C. Gupta, "Production Technology", Khanna Publishers. 16<sup>th</sup> Edition, 2001.
3. "H.M.T. Production Technology – Handbook", Tata McGraw-Hill, 2000.
4. Roy. A. Linberg, "Process and Materials of Manufacture", PHI, 2000.
5. M. Adithan and A.B. Gupta, "Manufacturing Technology", New Age, 2006.

**AT2205**

**AUTOMOTIVE COMPONENTS LABORATORY**

**L T P C**  
**0 0 3 2**

1. Dismantling and study of Multi-cylinder Petrol Engine
2. Assembling of Multi-cylinder Petrol Engine
3. Dismantling and study of Multi-cylinder Diesel Engine
4. Assembling of Multi-cylinder Diesel Engine
5. Study of petrol engine fuel system
6. Study of diesel engine fuel system
7. Study and measurement of light and heavy commercial Vehicle Frame
8. Study, dismantling and assembling of front and rear Axles
9. Study, dismantling and assembling of differential
10. Study, dismantling and assembling of Clutch
11. Study, dismantling and assembling of Gear Box
12. Study of steering system

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENTS**  
***(for a batch of 30 students)***

1.	Multi Cylinder Petrol Engine	2 No.
2.	Multi Cylinder Diesel Engine	2 No.
3.	Petrol and Diesel fuel systems	2No Each
4.	Heavy duty vehicle chassis frame	1 No.
5.	Light duty vehicle chassis frame	1 No.
6.	Front axle	2 No.
7.	Rear axle	2 No.
8.	Differential	2 No
9.	Clutch and Gear box (light duty, heavy duty)	2 No. each
10.	Steering systems with different gearboxes	4 No.

**AT2207**

**FLUID MECHANICS AND MACHINERY LAB**  
**(Offered Automobile only)**

**L T P C**  
**0 0 3 2**

**LIST OF EXPERIMENTS**

1. Determination of the Coefficient of discharge of given Orifice and Venturi meter.
2. Calculation of the rate of flow using Rota meter.
3. Determination of friction factor of given set of pipes.
4. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump

5. Conducting experiments and drawing the characteristic curves of reciprocating pump.
6. Conducting experiments and drawing the characteristic curves of Gear pump.
7. Conducting experiments and drawing the characteristic curves of Pelton wheel.
8. Conducting experiments and drawing the characteristics curves of Francis turbine.
9. Conducting experiments and drawing the characteristic curves of Kaplan turbine.
10. Flow visualization experiment on the effects of sharp corner and rounded corner and add-on devices in automobiles
11. Drag estimation on models of automobiles of different shapes

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENTS**  
*(for the batch of 30 students)*

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Centrifugal pump/submergible pump setup
6. Reciprocating pump setup
7. Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup Kaplan turbine setup
10. Wind tunnel with pressure measuring devices

**AT2206            MANUFACTURING TECHNOLOGY LABORATORY**  
(Common to Aeronautical & Automobile)

**L T P C**  
**0 0 3 2**

**LIST OF EXPERIMENTS**

- 1.    LATHE**
  - 1.1. Facing, plain turning and step turning
  - 1.2. Taper turning using compound rest.
  - 1.3. Taper turning using taper turning attachment
  - 1.4. Single start V thread, cutting and knurling
  - 1.5. Boring and internal thread cutting.
  
- 2.    SHAPER AND SLOTTER**
  - 2.1. Machining a V- block (in a Shaper)
  - 2.2. Machining hexagonal shape (in a Shaper)
  - 2.3. Machining internal key-way (in a slotter)

**3. DRILLING**

- 3.1 Drilling 4 or 6 holes at a given pitch circle on a plate
- 3.2 Drilling, reaming and tapping

**4. MILLING**

- 4.1 Plain Milling Exercise
- 4.2 Gear Milling Exercise

**5. GRINDING**

Cylindrical Grinding Exercise

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENTS (For A Batch Of 30 Students)**

1.	Centre Lathe with accessories	5No.
2.	Shaping Machine	2 No.
3.	Slotting Machine	1 No.
4.	Radial Drilling Machine	2No.
5.	Upright Drilling Machine	2No.
6.	Milling Machine	2No.
7.	Cylindrical Grinding Machine	1 No.

**MA2266**

**STATISTICS AND NUMERICAL METHODS**  
(Common to Mechanical, Automobile & Production)

**L T P C**  
**3 1 0 4**

**UNIT I TESTING OF HYPOTHESIS**

**9 + 3**

Sampling distributions - Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

**UNIT II DESIGN OF EXPERIMENTS**

**9 + 3**

Completely randomized design – Randomized block design – Latin square design -  $2^2$  - factorial design.

**UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**

**9 + 3**

Newton-Raphson method- Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method - Eigenvalues of a matrix by Power method .

**UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION  
AND NUMERICAL INTEGRATION**

**9 +3**

Lagrange's and Newton's divided difference interpolation –Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's 1/3 rules.

**UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL  
EQUATIONS**

**9+ 3**

Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Milne's predictor-corrector methods for solving first order equations - Finite difference methods for solving second order equation.

**L = 45 T = 15 TOTAL = 60 PERIODS**

**TEXT BOOKS**

1. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, 2007 (For units 3, 4 and 5).
2. Grewal, B.S. and Grewal, J.S., "Numerical methods in Engineering and Science", 6<sup>th</sup> Edition, Khanna Publishers, New Delhi, 2004.

**REFERENCES:**

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8<sup>th</sup> edition, 2007.
2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", Tata McGraw Hill edition, 2004.
3. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5<sup>th</sup> Edition, Tata McGraw-Hill, New Delhi, 2007.
4. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6<sup>th</sup> Edition, Pearson Education Asia, New Delhi, 2006.

**AT2251 APPLIED THERMODYNAMICS AND HEAT TRANSFER**

**L T P C  
3 1 0 4**

**UNIT I GAS POWER CYCLES**

**10+3**

Air standard cycles-Otto-Diesel-Dual-Work output, Efficiency and MEP calculations – comparison of the cycles for same compression ratio and heat addition, same compression ratio and heat rejection, same peak pressure, peak temperature and heat rejection, same peak pressure and heat input, same peak pressure and work output , Brayton cycle with intercooling, reheating and regeneration.

**UNIT II RECIPROCATING AIRCOMPRESSORS & REFRIGERATION CYCLES 10+3**

Single acting and double acting air compressors, work required, effect of clearance volume, volumetric efficiency, isothermal efficiency, free air delivery, multistage compression, condition for minimum work. Fundamentals of refrigeration, C.O.P., reversed carnot cycle, simple vapour compression refrigeration system, T-S, P-H

diagrams, simple vapour absorption refrigeration system, desirable properties of an ideal refrigerant.

### **UNIT III CONDUCTION**

**10+2**

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Use of Heislers Chart.

### **UNIT IV CONVECTION**

**10+2**

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar and Turbulent Flow – Combined Laminar and Turbulent – Flow over Bank of tubes – Free Convection – Dimensional Analysis – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

### **UNIT V RADIATION**

**8+2**

Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoff Law –Black Body Radiation –Grey body radiation Shape Factor Algebra – Electrical Analogy – Radiation Shields –Introduction to Gas Radiation.

**TOTAL: 60 PERIODS**

### **TEXT BOOKS**

1. R.K.Rajput “Applied Thermodynamics”, Laxmi Publishing Co.,New Delhi,2007
2. J.P. Holman “Heat Transfer”, Tata Mc Graw –Hill, 2003

### **REFERENCES**

1. P.K.Nag ”Basic and applied Thermodynamics” Tata McGraw –Hill Publishing Co. Ltd,New Delhi,2004
2. P..K.Nag “ Heat Transfer”, Tata McGraw-Hill, New Delhi, 2002
3. C.P Kothandaraman “Fundamentals of Heat and Mass Transfer” New Age International, New Delhi, 1998

**OBJECTIVE**

To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

**REVIEW (NOT FOR EXAM):**

Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number.

**UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9**

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectoid, eutectic, peritectic, and peritectoid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron, microstructure, properties and applications.

**UNIT II HEAT TREATMENT 9**

Definition – Full annealing, stress relief, recrystallisation and spheroidizing –normalising, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram, CCR - Hardenability, Jominy end quench test – Austempering, martempering – case hardening - carburising, nitriding, cyaniding, carbonitriding, flame and induction hardening.

**UNIT III MECHANICAL PROPERTIES AND TESTING 9**

Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep tests, fracture toughness tests.

**UNIT IV FERROUS AND NON FERROUS METALS 9**

Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels – HSLA - maraging steels – Cast Irons - Grey, White malleable, spheroidal – Graphite, Alloy cast irons, Copper and Copper alloys - Brass, Bronze and Cupronickel – Aluminum and Al-Cu alloy – precipitation hardening– Bearing alloys.

**UNIT V NON-METALLIC MATERIALS 9**

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers – Urea and Phenol Formaldehydes – Engineering Ceramics – Introduction to Fibre reinforced plastics.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Kenneth G.Budinski and Michael K.Budinski “Engineering Materials” Prentice-Hall of India Private Limited, 4<sup>th</sup> Indian Reprint 2002.



**UNIT IV BEAMDEFLECTION****9**

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area Method – Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns

**UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS****9**

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

**TUTORIALS 15 TOTAL: 60 PERIODS****TEXT BOOKS**

1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997
2. Beer F. P. and Johnston R," Mechanics of Materials", McGraw-Hill Book Co, Third Edition, 2002.

**REFERENCES**

1. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, New York, 1995
2. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 1981.
3. Ryder G.H, "Strength of Materials, Macmillan India Ltd"., Third Edition, 2002
4. Ray Hulse, Keith Sherwin & Jack Cain, "Solid Mechanics", Palgrave ANE Books, 2004.
5. Singh D.K "Mechanics of Solids" Pearson Education 2002.
6. Timoshenko S.P, "Elements of Strength of Materials", Tata McGraw-Hill, New Delhi, 1997.

**ME 2255****ELECTRONICS AND MICROPROCESSORS  
(Common to Mechanical, Production & Automobile)****L T P C  
3 0 0 3****OBJECTIVE**

To enable the students to understand the fundamental concepts of Semi Conductors, Transistors, Rectifiers, Digital Electronics and 8085 Microprocessors

**UNIT I SEMICONDUCTORS AND RECTIFIERS****9**

Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction-Zenor effect-Zenor diode characteristics-Half wave and full wave rectifiers -Voltage regulation

**UNIT II TRANSISTORS AND AMPLIFIERS****12**

Bipolar junction transistor- CB, CE, CC configuration and characteristics-Biasing circuits-Class A, B and C amplifiers- Field effect transistor-Configuration and characteristic of FET amplifier-SCR, Diac, Triac, UJT-Characteristics and simple applications-Switching

transistors-Concept of feedback-Negative feedback-Application in temperature and motor speed control.

**UNIT III DIGITAL ELECTRONICS 9**

Binary number system - AND, OR, NOT, NAND, NOR circuits-Boolean algebra-Exclusive OR gate - Flip flops-Half and full adders-Registers-Counters-A/D and D/A conversion.

**UNIT IV 8085 MICROPROCESSOR 9**

Block diagram of microcomputer-Architecture of 8085-Pin configuration-Instruction set-Addressing modes-Simple programs using arithmetic and logical operations.

**UNIT V INTERFACING AND APPLICATIONS OF MICROPROCESSOR 6**

Basic interfacing concepts - Interfacing of Input and Output devices-Applications of microprocessor Temperature control, Stepper motor control, traffic light control.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Milman and Halkias, "Integrated Electronics", Tata McGraw-Hill publishers, 1995.
2. Ramesh Goankar, "Microprocessor Architecture", Programming and Applications with 8085, Wiley Eastern, 1998.

**REFERENCES**

1. Malvino and Leach, "Digital Principles and Applications", Tata McGraw-Hill, 1996
2. Mehta V.K, "Principles of Electronics", S. Chand and Company Ltd., 1994
3. Douglas V.Hall, "Microprocessor and Interfacing", Programming and Hardware, Tata McGraw-Hill, 1999.
4. Salivahanan S, Suresh Kumar N, Vallavaraj A, "Electronic Devices and Circuits" First Edition, Tata McGraw-Hill, 1999.

**AT2252**

**AUTOMOTIVE CHASSIS**

**L T P C  
3 0 0 3**

**OBJECTIVE:**

Study of the Constructional details and Theory of important drive line, Structural, Steering, Braking and Suspension Systems of Automobiles.

Problem-Solving in Steering Mechanism, Propeller Shaft, Braking and Suspension Systems are to be done.

**UNIT I INTRODUCTION 9**

Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames, Types of Front Axles and Stub Axles, Front Wheel Geometry, namely, Castor, Camber, King Pin Inclination and Toe-in, Condition for True Rolling Motion of Wheels during Steering, Ackerman's and Daut's Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears, Slip Angle,

Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power–Assisted Steering.

**UNIT II DRIVE LINE 9**

Effect of Driving Thrust, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Front Wheel drive, Final drive, different types, Double reduction and twin speed final drives, Multi–axled vehicles, Differential principle and types, Differential housings, Non–Slip differential, Differential locks, Final drive of Crawler Tractors.

**UNIT III AXLES 9**

Construction and Design of Drive Axles, Types of Loads acting on drive axles, Full – Floating, Three–Quarter Floating and Semi–Floating Axles, Axle Housings and Types, Types and Constructional Details of Different Types of Wheels and Rims, Different Types of Tyres and their constructional details.

**UNIT IV SUSPENSION SYSTEM 9**

Need for Suspension System, Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi–Leaf, Coil, Torsion bar, Rubber, Pneumatic and Hydro – elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details, Design of Leaf and Coil Springs.

**UNIT V BRAKING SYSTEM 9**

Theory of Automobile Braking, Stopping Distance Time and Braking Efficiency, Effect of Weight Transfer during Braking, Theory of Drum Brakes, Leading and Trailing Shoes, Braking Torque, Constructional Details of Drum Brake and its Activators, Disc Brake Theory, Types and Construction, Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Servo Brakes, Retarders, Types and Construction, Anti–Lock Braking System, Constructional Details.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Kripal Singh, “Automobile Engineering”
2. R.K. Rajput, “A Text–Book of Automobile Engineering”, Laxmi Publications Private Limited
3. N.K. Giri, “Automotive Mechanics” Khanna Publishers, New Delhi, 2005.

**REFERENCES**

1. Heldt P.M., “Automotive Chassis” Chilton Co., New York.
2. Newton Steeds and Garret, “Motor Vehicles” 13<sup>th</sup> Edition, Butterworth, London, 2005.
3. Heinz Hazler, “Modern Vehicle Technology”, Butterworth, London, 2005.

**AT2255**

**ENGINE PERFORMANCE AND EMISSION TESTING LAB**

**L T P C**  
**0 0 3 2**

**LIST OF EXPERIMENTS**

1. Study of hydraulic, electrical and eddy current dynamometers
2. Valve timing and port timing diagram
3. Performance and emission test on two wheeler SI engine
4. Performance and emission test on automotive multi-cylinder SI engine
5. Performance and emission test on automotive multi-cylinder CI engine
6. Retardation test on I.C. Engines.
7. Heat balance test on automotive multi-cylinder SI engine
8. Heat balance test on automotive multi-cylinder CI engine
9. Morse test on multi-cylinder SI engine
10. P- $\theta$  and P-V diagrams for IC engine with piezo-electric pick up, charge amplifier, angle encoder and PC

**LIST OF EQUIPMENTS**  
**(for a batch of 30 students)**

- |     |   |             |
|-----|---|-------------|
| 1.  | Hydraulic dynamometer   | - 1 No.     |
| 2.  | Eddy current dynamometer  | - 1 No.     |
| 3.  | Electrical dynamometer  | - 1 No.     |
| 4.  | Single cylinder two stroke cut section engine                             | - 1 No.     |
| 5.  | Single cylinder four stroke cut section engine                            | - 1 No.     |
| 6.  | Two-wheeler engine test rig.  | - 1 No.     |
| 7.  | Automotive multicylinder SI engine test rig with heat balance arrangement | - 1 No.     |
| 8.  | Automotive multicylinder CI engine test rig with heat balance arrangement | - 1 No.     |
| 9.  | Emission Measuring Instruments for Petrol & Diesel Engines                | - 1 No each |
| 10. | Piezo-electric pick up, Charge Amplifier, Angle Encoder and PC            | - 1 set     |

**TOTAL: 45 PERIODS**

**AT2256**

**COMPUTER AIDED MACHINE DRAWING LAB**  
**(Common to Automobile & Production)**

**L T P C**  
**0 0 3 2**

1. Drawing of automobile components such as piston, connecting rod, valves, manifold and crank shaft.
2. Assembly drawing of screw jack, piston – connecting rod assembly, valve assembly, clutch assembly and gear box assembly.

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENTS**  
**(For a batch of 30 students)**

- |    |                |     |           |               |
|----|----------------|-----|-----------|---------------|
| 1. | Computer nodes |     | - 30 Nos. |               |
| 2. | Software       |     |           |               |
|    |                | i)  | Auto CAD  | - 15 licenses |
|    |                | ii) | Pro-E     | - 5 Nos.      |

**AT 2257**

**ELECTRONICS AND MICROPROCESSORS LAB**

**L T P C**  
**0 0 3 2**

**OBJECTIVE**

To supplement the theoretical knowledge with practical use of electronic components and programming and control using micro-processors

**LIST OF EXPERIMENTS**

**ELECTRONICS**

**30**

VI Characteristics of PN Junction Diode

VI Characteristics of Zener Diode

Characteristics of CE Transistor

Characteristics of JFET

Characteristics of Uni Junction Transistor

RC or Wein Bridge Oscillator

Study of Logic Gates (Basic Gates)

Half Adder and Full Adder

Shift Registers and Counters

Operational Amplifier (Adder, Subtractor, Differentiator, Integrator, Inverting and Non - Inverting)

**MICROPROCESSORS**

**15**

Block Transfer

8 bit Addition, Subtraction

Multiplication and Division

Maximum and Minimum of block of data

Sorting

Stepper Motor Interfacing

**LIST OF EQUIPMENT**  
(for a batch of 30 students)

Voltmeters	5 No.
Ammeters	5 No.
PN Diode, BJT, JFET, Logic Gates, Shift Registers and Counters	1 set.
Digital Logic Trainer Kits	1 No.
Breadboards	1 No.
Microprocessor Kits – 8085	5 No.
D/A Converter Interface	1 No.
Stepper Motor Interface	1 No.
CRO	1 No.
Waveform Generator	1 No.
Multimeter	1 No.

**TOTAL : 45 PERIODS**

**ME 2256**

**STRENGTH OF MATERIALS LAB**  
(Common to Auto, Mechanical & Production)

**L T P C**  
**0 0 3 2**

**OBJECTIVE**

To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness

**LIST OF EXPERIMENTS**

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
  - (i) Unhardened specimen
  - (ii) Quenched Specimen and
  - (iii) Quenched and tempered specimen.
11. Microscopic Examination of Hardened samples and
  - (ii) Hardened and tempered samples.

### **LIST OF EQUIPMENT**

(for a batch of 30 students)

Universal Tensile Testing machine with double shear attachment – 40 Ton Capacity	1
Torsion Testing Machine (60 NM Capacity)	1
Impact Testing Machine (300 J Capacity)	1
Brinell Hardness Testing Machine	1
Rockwell Hardness Testing Machine	1
Spring Testing Machine for tensile and compressive loads (2500 N)	1
Metallurgical Microscopes	3
Muffle Furnace (800 °C)	

**TOTAL : 45 PERIODS**

**GE2021 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C**  
**3 0 0 3**

#### **AIM**

- The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participates.

#### **OBJECTIVE**

- At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 11**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION 9**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES 10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

**UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

**UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2<sup>nd</sup> edition, Pearson Education (2004).

- Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

## REFERENCES

- R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
- Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
- Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
- Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

**ME2303**

**DESIGN OF MACHINE ELEMENTS**

**L T P C**

**3 1 0 4**

## OBJECTIVES

- To familiarise the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components

## UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS

**9**

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties -- Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and 'C' frame - Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations

## UNIT II DESIGN OF SHAFTS AND COUPLINGS

**10**

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys, key ways and splines - Design of crankshafts -- Design of rigid and flexible couplings.

## UNIT III DESIGN OF TEMPORARY AND PERMANENT JOINTS

**9**

Threaded fasteners - Design of bolted joints including eccentric loading, Knuckle joints, Cotter joints – Design of welded joints, riveted joints for structures - theory of bonded joints.

## UNIT IV DESIGN OF ENERGY STORING ELEMENTS

**8**

Design of various types of springs, optimization of helical springs -- rubber springs -- Design of flywheels considering stresses in rims and arms, for engines and punching machines.

## **UNIT V DESIGN OF BEARINGS AND MISCELLANEOUS ELEMENTS**

**9**

Sliding contact and rolling contact bearings -- Design of hydrodynamic journal bearings, McKee's Eqn. Sommerfield Number, Raimondi & Boyd graphs, -- Selection of Rolling Contact bearings -- Design of Seals and Gaskets -- Design of Connecting Rod.

**LECTURE: 45 TUTORIAL: 15 TOTAL: 60 PERIODS**

**Note: (Use of P S G Design Data Book is permitted in the University examination)**

### **TEXT BOOKS**

1. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", Sixth Edition, Tata McGraw-Hill , 2003.
2. Bhandari V.B, "Design of Machine Elements", Second Edition, Tata McGraw-Hill Book Co, 2007.

### **REFERENCES**

1. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Ugural A.C, "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
4. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2004.

### **STANDARDS**

1. IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 1 : Construction.
2. IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 2 : Friction and Wear.
3. IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 3 : Lubrication.

**AT2301**

**AUTOMOTIVE TRANSMISSION**

**L T P C**

**3 1 0 4**

### **OBJECTIVE**

- To impart basic knowledge to students with respect to transmission system of automobiles and impart knowledge that will enable the students to understand the latest developments in the field.

## **UNIT I CLUTCH**

**12**

Requirement of transmission system. Types of transmission system. Types of clutches. Requirement of clutches. Principle of friction clutch. Construction and operation of single plate coil spring clutch. Single plate diaphragm spring clutch, multiplate clutch, cone clutch and electro magnetic clutch.

**UNIT II GEAR BOX 12**

Problems on performance of automobile such as resistance to motion, tractive effort, engine speed & power and acceleration. Determination of gear ratio for passenger car, heavy vehicle and tractors. Objectives and need of gear box in a vehicle. Construction and operation of Sliding mesh gear box, constant mesh gear box, Synchronizers –need, principle of operation and types such as Early Warner and Later Warner gear synchronizers.

**UNIT III HYDROMATIC DRIVE 12**

Fluid coupling: Principle of operation. Constructional details. Torque capacity. Performance characteristics. Reduction of drag torque. Hydrodynamic torque converter: Principle of operation, constructional details, performance characteristics, multistage torque converter, polyphase torque converter and converter coupling.

**UNIT IV EPICYCLIC GEAR BOXES 12**

Introduction to epicyclic gear train – external mesh and internal mesh planetary gear trains. Ford – T – model gear box. Wilson gear box, Cotal Electro magnetic gear box , Automatic transmission. Hydraulic control system for automatic transmission.

**UNIT V HYDROSTATIC AND ELECTRIC DRIVE 12**

Hydrostatic drive: Various types of hydrostatic drives, principle of hydrostatic drive system, advantages & limitations, comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical Janny hydrostatic drive. Electric drives: Principle of early Ward Leonard and modified Ward Leonard control system, advantages & limitations.

**LECTURES: 45 TUTORIALS: 15 TOTAL = 60 PERIODS**

**TEXT BOOKS**

1. Newton and Steeds, Motor vehicles, Illife Publishers, 2002.
2. Heldt .P.M, Torque converters, Chilton Book Co., 1992.

**REFERENCES**

1. Judge.A.W. Modern Transmission systems, Chapman and Hall Ltd, 2000.
2. Heinz Heisler, Advanced Vehicle Technology, Butterworth Heinemann, 2002.
3. Hydrostatic Transmission for vehicle applications, I.Mech E.Conference, 1981-88

**AT2302 AUTOMOTIVE ELECTRICAL AND ELECTRONICS L T P C  
3 0 0 3**

**OBJECTIVE**

- To impart knowledge to the students in the principles of operation and constructional details of various Automotive Electrical and Electronic Systems like Batteries, Starting System, Charging System, Ignition System, Lighting System and Dash – Board Instruments.

**UNIT I TYPES OF BATTERIES 9**

Principle and construction of Lead Acid Battery, Nickel – Cadmium Battery, Nickel Metal, Hybrid Battery, Sodium Sulphur Battery and Aluminium Air Battery, Characteristics of

Battery, Battery Rating, Capacity and Efficiency, Various Tests on Battery, Battery-Charging Techniques, .Maintenance of batteries.

**UNIT II ELECTRICAL COMPONENTS 9**

Requirements of Starter Motor, Starter Motor types , construction and characteristics, Starter drive mechanisms, Starter Switches and Solenoids, Charging system components, Generators and Alternators ,types, construction and Characteristics . Voltage and Current Regulation, Cut –out relays and regulators, Charging circuits for D.C. Generator, A.C. Single Phase and Three – Phase Alternators.

**UNIT III IGNITION SYSTEMS 9**

Battery Coil and Magneto–Ignition System, Circuit details and Components of Battery Coil and Magneto–Ignition System, Centrifugal and Vacuum Advance Mechanisms, Spark Plugs, Constructional details and Types.

**UNIT IV ELECTRICAL AND ELECTRONIC IGNITION SYSTEMS 9**

Electronically–Assisted and Full Electronic Ignition System, Non–Contact–type Ignition Triggering devices, Capacitive Discharge Ignition Distributor–less Ignition System, Digital Ignition System, Control Strategy of Electronic Ignition System.

**UNIT V WIRING, LIGHTING AND OTHER INSTRUMENTS AND SENSORS 9**

Automotive Wiring, Insulated and Earth Return System, Positive and Negative Earth Systems, Head Lamp and Indicator Lamp Details, Anti–Dazzling and Dipper Details, Electrical and Electronic Fuel Lift Pumps, Theory and Constructional Details of Dash Board Instruments and their Sensors like Speedometer, Odometer, Fuel Level Indicator Oil Pressure and Coolant Temperature Indicators, Horns and Wiper Mechanisms, Automotive Wiring Circuits.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Young, A.P. and Griffith, S.L., Automobile Electrical Equipments, ELBS and New Press.
2. Kholi .P.L.Automotive Electrical Equipment,Tata McGraw-Hill co ltd,New Delhi,2004

**REFERENCES**

1. Crouse.W.H. Automobile Electrical Equipment,McGraw Hill Book Co Inc.NewYork,2005
2. Judge.A.W.Modern Electrical Equipments of Automobiles,Chapman & Hall, London 2004
3. Robert Bosch, Automotive Handbook, Bently Publishers,2004

**AT 2303 VEHICLE DESIGN AND DATA CHARACTERISTICS L T P C  
3 1 0 4**

**OBJECTIVE**

Students have to collect important technical specifications of an automobile from Automobile Journals and keeping this, as a guide, they have to calculate and tabulate

various vehicle performance parameters and design parameters and to draw curves using these data.

**UNIT I INTRODUCTION 12**

Assumptions to be made in designing a vehicle, Range of values for Gross Vehicle Weight, Frontal Area, maximum speed, maximum acceleration, gradability in different gears, Basics of Automobile Design.

**UNIT II RESISTANCE TO VEHICLE MOTION 12**

Calculation, Tabulation and Plotting of Curves for Air and Rolling Resistances at various vehicle speeds, Calculation and Plotting of Driving force, Power requirement for different loads and acceleration, Maximum Power calculation.

**UNIT III PERFORMANCE CURVES 12**

Calculation, Tabulation and Plotting of Torque and Mechanical Efficiency for different vehicle speeds, Interpolation of Pressure – Volume diagram, Calculation of frictional Mean Effective Pressure, Calculation of Engine Cubic Capacity, Bore and Stroke Length.

**UNIT IV 12**

Connecting rod length to Crank Radius Ratio, Plotting of Piston Velocity and Acceleration against Crank Angle, Plotting Gas force, inertia force and Resultant force against Crank Angle, Turning Moment and Side Thrust against Crank Angle.

**UNIT V GEAR RATIOS 12**

Determination of Gear Ratios, Acceleration and Gradability, Typical Problems on Vehicle performance

**TOTAL: 60 PERIODS**

**TEXT BOOKS**

- 1 N. K. Giri, Automotive Mechanics, Khanna Publishers, New Delhi, 2005.
2. Heldt, P.M., High Speed Combustion Engines, Oxfore and I.B.H. Publishing Co., Kolkata, 2002.

**REFERENCE**

1. R.B.Gupta, Automobile Engineering.

**AT2305 AUTOMOTIVE FUELS AND LUBRICANTS L T P C  
3 0 0 3**

**OBJECTIVE**

To understand the source of automotive fuels and lubricants, their basic properties, determination of air requirement for the combustion of fuels and basic theory of lubrication.

**UNIT I MANUFACTURE OF FUELS AND LUBRICANTS 9**

Fuels, Structure of petroleum, refining process, thermal and catalytic cracking, products of refining process, manufacture of lubricating oil base stocks and finished automotive lubricants.

**UNIT II FUELS FOR I.C. ENGINES 9**

Types of Fuels, Liquid and gaseous fuels, heating value of fuels, higher and lower heating values, chemical structure of hydro-carbons SI Engine fuels, Volatility characteristics, desirable characteristics of SI Engine fuels, knock rating and additives, alternate fuels for SI engines. CI engine fuels, desirable characteristics, cetane rating, alternate fuels for CI engines, biodiesels.

**UNIT III COMBUSTION OF FUELS 9**

Stoichiometry - calculation of theoretically correct air required for combustion of liquid and gaseous fuels, volumetric and gravimetric analysis of the dry products of combustion, mass of dry gas per kg of fuel burnt, mass of carbon in the exhaust gas, mass of carbon burnt to carbon-monoxide per kg of fuel, heat loss due to incomplete combustion, exhaust gas analysis by Orsat apparatus.

**UNIT IV THEORY OF LUBRICATION 9**

Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, Hydrostatic lubrication bearing lubrication, functions of the lubrication system.

**UNIT V LUBRICANTS 9**

Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, testing of grease.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. V.Ganesan, "Internal Combustion Engines" Tata McGraw-Hill Publishing Co. Newdelhi
2. M.L.Mathur and P.Sharma "A course in internal combustion engines", Dhanpatrai Publications

**REFERENCES**

1. Brame, J.S.S. and King, J.G. – Fuels – Solids, Liquids, Gaseous.
2. Francis, W – Fuels and Fuel Technology, Vol. I & II
3. Hobson, G.D. & Pohl.W- Modern Petroleum Technology
4. A.R.Lansdown – Lubrication – A practical guide to lubricant selection – Pergamon press – 1982.
5. Raymond.C.Gunther – Lubrication – Chilton Book Co., - 1971. .

Globalisation has brought in numerous opportunities for the teeming millions, with more focus on the students' overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them in their profession.

**OBJECTIVES:**

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

**I. PC based session****(Weightage 40%)****24 periods****A. ENGLISH LANGUAGE LAB****(18 Periods)****1. LISTENING COMPREHENSION: (6)**

Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.

**2. READING COMPREHENSION: (6)**

Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

**3. SPEAKING: (6)**

Phonetics: Intonation – Ear training - Correct Pronunciation – Sound recognition exercises – Common Errors in English.

Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

**B. DISCUSSION OF AUDIO-VISUAL MATERIALS****(6 PERIODS)****(Samples are available to learn and practice)****1. RESUME / REPORT PREPARATION / LETTER WRITING****(1)**

Structuring the resume / report - Letter writing / Email Communication - Samples.

2. **PRESENTATION SKILLS:** (1)  
Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples
3. **SOFT SKILLS:** (2)  
Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples
4. **GROUP DISCUSSION:** (1)  
Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples
5. **INTERVIEW SKILLS:** (1)  
Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews-Video samples.

<b>II. Practice Session</b>	<b>(Weightage – 60%)</b>	<b>24 periods</b>
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1. **Resume / Report Preparation / Letter writing:** Students prepare their own resume and report. (2)
2. **Presentation Skills:** Students make presentations on given topics. (8)
3. **Group Discussion:** Students participate in group discussions. (6)
4. **Interview Skills:** Students participate in Mock Interviews (8)

#### REFERENCES

1. Anderson, P.V, **Technical Communication**, Thomson Wadsworth, Sixth Edition, New Delhi, 2007.
2. Prakash, P, **Verbal and Non-Verbal Reasoning**, Macmillan India Ltd., Second Edition, New Delhi, 2004.
3. John Seely, **The Oxford Guide to Writing and Speaking**, Oxford University Press, New Delhi, 2004.
4. Evans, D, **Decisionmaker**, Cambridge University Press, 1997.
5. Thorpe, E, and Thorpe, S, **Objective English**, Pearson Education, Second Edition, New Delhi, 2007.
6. Turton, N.D and Heaton, J.B, **Dictionary of Common Errors**, Addison Wesley Longman Ltd., Indian reprint 1998.

#### LAB REQUIREMENT

1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

**Requirement for a batch of 60 students**

<b>Sl.No.</b>	<b>Description of Equipment</b>	<b>Quantity required</b>
1.	<b>Server</b>	1 No.
	o PIV system	
	o 1 GB RAM / 40 GB HDD	
	o OS: Win 2000 server	
	o Audio card with headphones (with mike)	
	o JRE 1.3	
2.	<b>Client Systems</b>	60 No.
	o PIII or above	
	o 256 or 512 MB RAM / 40 GB HDD	
	o OS: Win 2000	
	o Audio card with headphones (with mike)	
	o JRE 1.3	
3.	Handicam Video Camera (with video lights and mic input)	1 No.
4.	Television - 29"	1 No.
5.	Collar mike	1 No.
6.	Cordless mikes	1 No.
7.	Audio Mixer	1 No.
8.	DVD Recorder / Player	1 No.
9.	LCD Projector with MP3 /CD /DVD provision for audio / video facility - <b>Desirable</b>	1 No.

**AT2307      AUTOMOTIVE ELECTRICAL AND ELECTRONICS  
LABORATORY**

**L T P C  
0 0 3 2**

**LIST OF EXPERIMENTS**

**a.      Electrical Laboratory**

1.      Testing of batteries and battery maintenance
2.      Testing of starting motors and generators

3. Testing of regulators and cut – outs
4. Diagnosis of ignition system faults
5. Study of Automobile electrical wiring

**b. Electronics Laboratory**

6. Study of rectifiers and filters
7. Study of logic gates, adder and flip-flops
8. Study of SCR and IC timer
9. Interfacing Sensors like RTD, LVDT, Load Cell etc.
10. Interfacing ADC for Data Acquisition
11. Interfacing DAC for Control Application
12. Interfacing A/D converter and simple data acquisition
13. Micro controller programming and interfacing
14. Interfacing Actuators
15. EPROM Programming
16. Fault Diagnosis of various sensors

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENT**

*(for a batch of 30 students)*

Battery, hydrometer, voltage tester	- 1 No. each
Starter motor, regulator, cut-out	- 1 No. each
Distributor, ignition coil, spark plug	- 1 No. each
Auto electrical wiring system	- 1 No.
Rectifiers, filters	- 1 No. each
Amplifier	- 1 No.
IC timer	- 1 No.
Data logger	- 1 No.
8085 trainer kit	- 10 Nos
ADC interface board	- 2 Nos
DAC interface board	- 2 Nos
Sensors like RTD, Load cell, LVDT	- 2 Nos
Actuators like stepper motor	- 2 Nos

**AT2308 AUTOMOTIVE FUELS AND LUBRICANTS LABORATORY**

**L T P C  
0 0 3 2**

**LIST OF EXPERIMENTS**

1. Study of International and National standards for fuels and lubricants.
2. Study of Octane and Cetane Number of fuels.
3. Testing of fuels - Ultimate analysis, proximate analysis
4. ASTM distillation test of liquid fuels
5. Aniline Point test of diesel
6. Calorific value of liquid fuel.
7. Calorific value of gaseous fuel.
8. Reid vapour pressure test.
9. Flash and Fire points of petrol and diesel.

10. Copper strip Corrosion Test
11. Cloud & Pour point Test.
12. Temperature dependence of viscosity of lubricants & Fuels by Redwood Viscometer.
13. Viscosity Index of lubricants & Fuels by Saybolt Viscometer
14. Ash content and Carbon Residue Test
15. Drop point of grease and mechanical penetration in grease.

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENT**  
(for a batch of 30 students)

- |  |              |
|--|--------------|
| 1. Fuel Analysis Test Apparatus<br>(for Ultimate and proximate analysis) | - 1 No. each |
| 2. Abels flash and fire point apparatus (for petrol)                     | - 1 No.      |
| 3. Aniline point Apparatus   | -1 No        |
| 4. Reid vapor pressure test Apparatus                                    | - 1 No.      |
| 5. Bomb and Gas Calorimeters   | - 1 No. each |
| 6. Carbon Residue Test Apparatus   | - 1 No.      |
| 7. Copper Strip Corrosion Test Apparatus                                 | - 1 No.      |
| 8. Cloud and Pour point Apparatus  | - 1 No.      |
| 9. Redwood Viscometer  | - 1 No.      |
| 10. Saybolt Viscometer   | - 1 No.      |
| 11. ASTM distillation test Apparatus                                     | - 1 No.      |
| 12. Ash content Test Apparatus   | - 1 No.      |
| 13. Drop point and penetration Apparatus for grease                      | - 1 No.      |

**MG 2351**

**PRINCIPLES OF MANAGEMENT**  
(Common to all Branches)

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

Knowledge on the principles of management is essential for all kinds of people in all kinds of organizations. After studying this course, students will be able to have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling. Students will also gain some basic knowledge on international aspect of management.

**UNIT I OVERVIEW OF MANAGEMENT**

**9**

Organization - Management - Role of managers - Evolution of Management thought - Organization and the environmental factors - Managing globally - Strategies for International Business.

**UNIT II PLANNING 9**

Nature and purpose of planning - Planning process - Types of plans – Objectives - - Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions.

**UNIT III ORGANIZING 9**

Nature and purpose of organizing - Organization structure - Formal and informal groups / organization - Line and Staff authority - Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment - Orientation - Career Development - Career stages – Training - - Performance Appraisal.

**UNIT IV DIRECTING 9**

Creativity and Innovation - Motivation and Satisfaction - Motivation Theories Leadership - Leadership theories - Communication - Hurdles to effective communication - Organization Culture - Elements and types of culture - Managing cultural diversity.

**UNIT V CONTROLLING 9**

Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control - Quality Control - Planning operations.

**TOTAL : 45 PERIODS**

**TEXT BOOKS:**

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.

**REFERENCES:**

1. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management – A global & Entrepreneurial Perspective', Tata Mcgraw Hill, 12<sup>th</sup> edition, 2007.
3. Andrew J. Dubrin, 'Essentials of Management', Thomson Southwestern, 7th edition, 2007.

**AT2351 AUTOMOTIVE ENGINE COMPONENTS DESIGN L T P C  
3 1 0 4**

**OBJECTIVE**

To make the students understand the design concept and principles of various engine components. These concepts and principles are familiarized for design of components.

**UNIT I INTRODUCTION 12**

Engineering materials - Introduction endurance limit, notch sensitivity. Tolerances, types of tolerances and fits, design considerations for interference fits, surface finish, surface roughness, Rankine's formula - Tetmajer's formula - Johnson formula- design of push-rods.

**UNIT II DESIGN OF CYLINDER, PISTON AND CONNECTING ROD 12**

Choice of material for cylinder and piston, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly. Material for connecting rod, determining minimum length of connecting rod, small end design, shank design, design of big end cap bolts.

**UNIT III DESIGN OF CRANKSHAFT 12**

Balancing of I.C. engines, significance of firing order. Material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations, development of short and long crankarms. Front and rear-end details.

**UNIT IV DESIGN OF FLYWHEELS 12**

Determination of the mass of a flywheel for a given co- efficient of speed fluctuation. Engine flywheel - stresses on the rim of the flywheels. Design of hubs and arms of the flywheel, turning moment diagram.

**UNIT V DESIGN OF VALVES AND VALVE TRAIN 12**

Design aspects of intake & exhaust manifolds, inlet & exhaust valves, valve springs, tappets and valve train. Design of cam & camshaft. Design of rocker arm. Cam profile generation.

**TOTAL: 60 PERIODS**

**Note:** (Use of P S G Design Data Book is permitted in the University examination)

**TEXT BOOK:**

1. Khurmi. R.S. & Gupta. J.K., A textbook of Machine Design, Eurasia Publishing House (Pvt) Ltd, 2001.

**REFERENCES:**

1. Jain.R.K, "Machine Design", Khanna Publishers, New Delhi, 2005.
2. Giri.N.K, Automobile Mechanics, Khanna Publishers, New Delhi, 2007.

**AT2352 AUTOMOTIVE CHASSIS COMPONENTS DESIGN L P T C  
3 1 0 4**

**OBJECTIVE:**

- At the end of the course the student will be able to understand the fundamental principles involved in design of components of automotive chassis, the complete design exercise and arrive at important dimensions of chassis components.

**UNIT I VEHICLE FRAME AND SUSPENSION 12**  
 Study of loads-moments and stresses on frame members. Design Of frame for passenger and commercial vehicle - Design of leaf Springs-Coil springs and torsion bar springs.

**UNIT II FRONT AXLE AND STEERING SYSTEMS 12**  
 Analysis of loads-moments and stresses at different sections of front axle. Determination of bearing loads at Kingpin bearings. Wheel spindle bearings. Choice of Bearings. Determination of optimum dimensions and proportions for steering linkages, ensuring minimum error in steering. Design of front axle beam.

**UNIT III CLUTCH 12**  
 Design of single plate clutch, multiplate clutch and cone clutch. Torque capacity of clutch. Design of clutch components, Design details of roller and sprag type of clutches.

**UNIT IV GEAR BOX 12**  
 Gear train calculations, layout of gearboxes. Calculation of bearing loads and selection of bearings. Design of three speed and four speed gearboxes.

**UNIT V DRIVE LINE AND REAR AXLE 12**  
 Design of propeller shaft. Design details of final drive gearing. Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings and design aspects of final drive.

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. Giri, N.K., Automobile Mechanics, Khanna publishers, New Delhi, 2007.
2. Khurmi. R.S. & Gupta. J.K., A textbook of Machine Design, Eurasia Publishing House (Pvt) Ltd, 2001.

**REFERENCES:**

1. Heldt, P.M., Automotive Chassis, Chilton Book Co., 1992.
2. Dean Aaverns, Automobile Chassis Design, Illife Book Co., 2001.

**AT2353**

**TWO AND THREE WHEELERS**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

The aim of this course is to make the students to know and understand the constructional details operating characteristics and vehicle design aspects

**UNIT I POWER UNIT 9**  
 Two stroke SI engine, four stroke SI engine; merits and demerits. Symmetrical and unsymmetrical port timing diagrams. Types of scavenging processes; merits and demerits, scavenging pumps. Rotary valve engine. Fuel system. Lubrication system. Magneto coil and battery coil spark ignition system, electronic ignition system. Starting system; Kick starter system.

**UNIT II CHASSIS AND SUB-SYSTEMS 9**  
 Mainframe and its types. Chassis and shaft drive, Single, multiple plates and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar.

**UNIT III BRAKES, WHEELS AND TYRES 9**  
 Drum brakes, disc brakes, front and rear brake links, layouts. Spoked wheel, cast wheel, disc wheel, disc types. Tyres and tubes.

**UNIT IV TWO WHEELERS 9**  
 Case study of major Indian models of motorcycles, scooters and mopeds. TVS mopeds and motorcycles, HeroHonda motorcycles, Bajaji scooters and motorcycles, Yamaha, Enfield motorcycles. Servicing and maintenance.

**UNIT V THREE WHEELERS 9**  
 Case study of Indian models. Auto rickshaws, pickup van, delivery van and trailer. Maintenance:& Fault tracing.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Irving.P.E. - Motor Cycle Engineering - Temple Press Book, London – 1992.
2. The Cycle Motor Manual - Temple Press Limited, London - 1990

**REFERENCES:**

1. Encyclopedia of Motorcycling - 20 volume Marshall, Cavensih, UK - 1989
2. Brayant R.V,Vespa - Maintenance and Repair Series – S.Chand & Co., New Delhi - 1986.
3. Raymond Broad Lambretta - A Practical Guide to maintenance and repair – S.Chand & Co., New Delhi - 1987.

**ME2353 FINITE ELEMENT ANALYSIS L T P C**  
**3 1 0 4**  
**INTRODUCTION (Not for examination) 5**

Solution to engineering problems – mathematical modeling – discrete and continuum modeling – need for numerical methods of solution – relevance and scope of finite element methods – engineering applications of FEA

**UNIT I FINITE ELEMENT FORMULATION OF BOUNDARY VALUE PROBLEMS 5+3**

Weighted residual methods –general weighted residual statement – weak formulation of the weighted residual statement –comparisons – piecewise continuous trial functions-example of a bar finite element –functional and differential forms – principle of stationary total potential – Rayleigh Ritz method – piecewise continuous trial functions – finite element method – application to bar element

**UNIT II ONE DIMENSIONAL FINITE ELEMENT ANALYSIS 8+3**

General form of total potential for 1-D applications – generic form of finite element equations – linear bar element – quadratic element – nodal approximation – development of shape functions – element matrices and vectors – example problems – extension to plane truss – development of element equations – assembly – element connectivity – global equations – solution methods – beam element – nodal approximation – shape functions – element matrices and vectors – assembly – solution – example problems

**UNIT III TWO DIMENSIONAL FINITE ELEMENT ANALYSIS 10+3**

Introduction – approximation of geometry and field variable – 3 noded triangular elements – four noded rectangular elements – higher order elements – generalized coordinates approach to nodal approximations – difficulties – natural coordinates and coordinate transformations – triangular and quadrilateral elements – iso-parametric elements – structural mechanics applications in 2-dimensions – elasticity equations – stress strain relations – plane problems of elasticity – element equations – assembly – need for quadrature formulae – transformations to natural coordinates – Gaussian quadrature – example problems in plane stress, plane strain and axisymmetric applications

**UNIT IV DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD 9+3**

Introduction – vibrational problems – equations of motion based on weak form – longitudinal vibration of bars – transverse vibration of beams – consistent mass matrices – element equations – solution of eigenvalue problems – vector iteration methods – normal modes – transient vibrations – modeling of damping – mode superposition technique – direct integration methods

**UNIT V APPLICATIONS IN HEAT TRANSFER & FLUID MECHANICS 8+3**

One dimensional heat transfer element – application to one-dimensional heat transfer problems- scalar variable problems in 2-Dimensions – Applications to heat transfer in 2-Dimension – Application to problems in fluid mechanics in 2-D

**TOTAL L=45, T=15=60 PERIODS**

**TEXT BOOKS:**

1. PSeshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007. ISBN-978-203-2315-5
2. J.N.Reddy, "An Introduction to the Finite Element Method", McGraw-Hill International Editions(Engineering Mechanics Series), 1993. ISBN-0-07-051355-4

**REFERENCES:**

1. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3<sup>rd</sup> Edition, Prentice-Hall of India, Eastern Economy Editions. ISBN-978-81-203-2106-9
2. David V.Hutton,"Fundamentals of Finite Element Analysis", Tata McGraw-Hill Edition 2005. ISBN-0-07-239536-2
3. Cook,Robert.D., Plesha,Michael.E & Witt,Robert.J. "Concepts and Applications of Finite Element Analysis",Wiley Student Edition, 2004. ISBN-10 81-265-1336-5

Note: L- no. of lectures/week, T- no. of tutorials per week

**AT2354**

**COMPUTER AIDED ENGINE DESIGN LAB**

**L T P C**  
**0 0 3 2**

**LIST OF EXPERIMENTS**

1. Design and drawing of piston  
Piston pin and piston rings and drawing of these components.
2. Design of connecting rod small end and big end, shank design, design of big end cap, bolts and drawing of the connecting rod assembly.
3. Design of crankshaft, balancing weight calculations.
4. Development of short and long crank arms, front end and rear end details, drawing of the crankshaft assembly.
5. Design and drawing of flywheel.
6. Ring gear design, drawing of the flywheel including the development of ring gear teeth.
7. Design and drawing of the inlet and exhaust valves.
8. Design of cam and camshaft, cam profile generation, drawing of cam and camshaft.
9. Design of combustion chamber.

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENTS**

(For a batch of 30 students)

1. Computer nodes - 15 Nos.
2. Software like AutoCAD or Pro-E - 15 licenses

**AT 2355**

**COMPUTER AIDED CHASSIS DESIGN LAB**

**L T P C**  
**0 0 3 2**

**LIST OF EXPERIMENTS**

**CLUTCH**

1. Complete design of clutch components.
2. Assembly drawing of clutch using drafting software.

**GEAR BOX**

3. Gear train calculations.
4. Layout of gear box.
5. Calculation of bearing loads
6. Selection of bearings.
7. Assembly drawing of gear box using drafting software.

**DRIVE LINE AND REAR AXLE**

8. Design of propeller shaft.
9. Design details of final drive gearing.

10. Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings
11. Design aspects of final drive.

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENTS**  
(for a batch of 30 students )

- |    |                                |               |
|----|--------------------------------|---------------|
| 1. | Computer nodes                 | - 15 Nos.     |
| 2. | Software like AutoCAD or Pro-E | - 15 licenses |

**AT2356**

**TWO AND THREE WHEELERS LAB**

**L T P C**  
**0 0 3 2**

**LIST OF EXPERIMENTS**

1. Performance test of a two wheeler using chassis dynamometer.
2. Performance test on shock absorber
3. Performance test on coil spring.
4. Two wheeler chain test
5. Brake and Clutch adjustment as per specification.
6. Dismantling and assembling of two wheeler gear box and finding gear ratios
7. Dismantling and assembling of three wheeler box and finding gear ratios
8. Three wheeler brake and clutch play adjustment
9. Dismantling and assembling of three wheeler steering system.
10. Study of three wheeler chassis frame and power transmission system.

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENTS**  
(for a batch of 30 students)

- |    |                                 |          |
|----|---------------------------------|----------|
| 1. | Two wheeler chassis dynamometer | - 1 No.  |
| 2. | Coil spring test rig            | - 1 No.  |
| 3. | Chain tension test rig          | - 1No.   |
| 4. | Shock absorber test rig         | - 1 No.  |
| 5. | Two-wheeler gearbox             | - 2 Nos. |
| 6. | Two-wheeler clutch              | - 2 Nos. |
| 7. | Three-wheeler brake assembly    | - 2 Nos. |
| 8. | Three-wheeler steering assembly | - 2 Nos. |
| 9. | Three-wheeler gear box          | - 2 Nos. |

**OBJECTIVE:**

To explain the principle of engines and vehicle electronic management system and different sensors used in the systems.

**UNIT I FUNDAMENTAL SOF AUTOMOTIVE ELECTRONICS 10**

Microprocessor architecture, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines and in the other parts of the automobile.

**UNIT II SENSORS 12**

Inductive, Hall effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, air mass flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors.

**UNIT III SI ENGINE MANAGEMENT 13**

Three way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control. Electronic ignition systems and spark timing control. Closed loop control of knock.

**UNIT IV CI ENGINE MANAGEMENT 13**

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced post injection and retarded post injection. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valves,

**UNIT V VEHICLE MANAGEMENT SYSTEMS 12**

ABS system, its need, layout and working. Electronic control of suspension – Damping control, Electric power steering, Supplementary Restraint System of air bag system – crash sensor, seat belt tightening. Cruise control. Vehicle security systems- alarms, vehicle tracking system. On board diagnostics. Collision avoidance Radar warning system.

**TOTAL: 60 PERIODS****TEXT BOOKS:**

1. Understanding Automotive Electronics William B Ribbens, SAE 1998
2. Automobile Electronics by Eric Chowanietz SAE

**REFERENCES:**

1. Diesel Engine Management by Robert Bosch, SAE Publications
2. Gasoline Engine Management by Robert Bosch, SAE Publications

**OBJECTIVE**

When the vehicle is at dynamic condition more vibration will be produced. It is essential to study about vibrations and how to reduce the vibration under different loads, speed and road conditions in order to improve the comfort for the passengers and life of the various components of the vehicle. In this subject these aspects have been given.

**UNIT I INTRODUCTION****12**

Fundamentals of vibration, single degree of freedom, two degree of freedom, multidegree freedom, free, forced and damped vibrations, modeling and simulation studies, model of an automobile, magnification factor, transmissibility, vibration absorber.

**UNIT II STABILITY OF VEHICLES****12**

Load distribution, calculation of acceleration, tractive effort and reactions for different drives, stability of a vehicle on a curved track, slope and a banked road,.

**UNIT III MULTI DEGREE FREEDOM SYSTEMS****12**

Closed and far coupled system, eigen value problems, orthogonality of mode shapes, modal analysis, forced vibration by matrix inversion.

**UNIT IV SUSPENSION, TYRES AND VEHICLE HANDLING****12**

Requirements, sprung mass frequency, wheel hop, wheel wobble, wheel shimmy, choice of suspension spring rate, calculation of effective spring rate, vehicle suspension in fore and aft, roll axis and vehicle under the action of side forces, tyre, dynamics, ride characteristics power consumed by a tyre. Oversteer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering.

**UNIT V NUMERICAL METHODS****12**

Approximate methods for determining fundamental frequency, Dunkerleys lower bound, Rayleighs upper bound, Holzer method for closed coupled system and branched systems.

**TOTAL: 60 PERIODS****TEXT BOOKS**

1. Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., 2002.
2. Giri N.K – Automotive Mechanics, Khanna Publishers, 2007.

**REFERENCES**

1. Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication - 2002.
2. Ellis.J.R - "Vehicle Dynamics"- Business Books Ltd., London- 1991
3. Gillespie T.D, "Fundamentals of Vehicle Dynamics", SAE USA 1992.
4. Giles.J.G.Steering - "Suspension and Tyres", Illiffe Books Ltd., London- 1998

**OBJECTIVE :**

At the end of the course, the students will be able to have a complete knowledge of the vehicle maintenance procedures and acquire skills in handling situations where the vehicle is likely to fail.

**UNIT I MAINTENANCE OF RECORDS AND SCHEDULES 10**

Requirements and importance of maintenance, types of maintenance, preparation of check lists, Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance. Motor vehicle acts, insurance etc and traffic rules, motor vehicle driving rules and regulation.

**UNIT II ENGINE MAINTENANCE – REPAIR AND OVERHAULING 9**

Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up, including modern engines.

**UNIT III CHASSIS MAINTENANCE - REPAIR AND OVERHAULING 10**

Mechanical and automobile clutch, fluid flywheel, torque converter, automatic transmission and gear box, servicing and maintenance. Maintenance servicing of propeller shaft and differential system. Maintenance servicing of suspension systems. Brake systems, types and servicing techniques. Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing.

**UNIT IV ELECTRICAL AND ELECTRONIC SYSTEM MAINTENANCE - SERVICING AND REPAIRS 8**

Testing methods for checking electrical and electronic components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

**UNIT V MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEM AND VEHICLE BODY 8**

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating system maintenance.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. John Doke "Fleet Management", McGraw-Hill Co. 1984.
2. Automotive Mechanics W.H. Crouse

**REFERENCES**

1. James D Halderman - Advanced Engine Performance Diagnosis—PHI 1998.
2. Service Manuals from Different Vehicle Manufacturers.



**REFERENCES:**

1. SAE Transactions- "Vehicle Emission"- 1982 (3 volumes).
2. Obert.E.F.- "Internal Combustion Engines"- 1988
3. Marco Nute- " Emissions from two stroke engines, SAE Publication – 1998

**AT2405 VEHICLE MAINTENANCE AND RECONDITIONING LAB**

**L T P C**  
**0 0 3 2**

**LIST OF EXPERIMENTS**

1. Study and layout of an automobile repair, service and maintenance shop.
2. Study and preparation of different statements/records required for the repair and maintenance works.
3. Cylinder reboring – checking the cylinder bore, Setting the tool and reboring.
4. Valve grinding, valve lapping - Setting the valve angle, grinding and lapping and checking for valve leakage
5. Calibration of fuel injection pump
6. Minor and major tune up of gasoline and diesel engines.
7. Study and checking of wheel alignment - testing of camber, caster.
8. Testing kingpin inclination, toe-in and toe-out
9. Brake adjustment and Brake bleeding.
10. Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.
11. Battery testing and maintenance.

**Practice the following:**

- I. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play
- II. Air bleeding from hydraulic brakes, air bleeding of diesel fuel system
- III. Wheel bearings tightening and adjustment
- IV. Adjustment of head lights beam
- V. Removal and fitting of tyre and tube

**TOTAL: 45 PERIODS**

**LIST OF EQUIPMENTS**

*(for a batch of 30 students)*

- |  |         |
|--|---------|
| 1. Engine Analyzer                     | - 1 No. |
| 2. Cylinder compression pressure gauge | - 1 No. |
| 3. Vacuum gauge                        | - 1 No. |
| 4. Spark plug cleaner and tester       | - 1 No. |
| 5. Cam angle and rpm tester            | - 1 No. |
| 6. Tachometer                          | - 1 No. |
| 7. Wheel alignment apparatus           | - 1 No. |
| 8. Gas welding equipment               | - 1 No. |
| 9. Tyre remover                        | - 1 No. |
| 10. Bearing puller                     | - 1 No. |
| 11. Head light alignment gauge         | - 1 No. |

- |     |   |              |
|-----|---|--------------|
| 12. | Service manuals of petrol, diesel engines                 | - 1 No: each |
| 13. | Cylinder reboring machine                                 | - 1No..      |
| 14. | Valve grinding machine                                    | - 1 No.      |
| 15. | Valve lapping machine                                     | - 1 No.      |
| 16. | Fuel injection calibration test bench with nozzle tester- | 1 No.        |
| 17. | HRD tester, Clamp on meter, Hydrometer                    | -1 No: each  |

**ME2309**

**CAD/CAM LAB**

**L T P C**  
**0 0 3 2**

**OBJECTIVES:**

- To be able to understand and handle design problems in a systematic manner.
- To gain practical experience in handling 2D drafting and 3D modeling software systems.
- To be able to apply CAD in real life applications.
- To understand the concepts G and M codes and manual part programming.
- To expose students to modern control systems (Fanuc, Siemens etc)
- To know the application of various CNC machines
- To expose students to modern CNC application machines EDM, EDM wire cut and Rapid Prototyping

**3D Geometric Modeling**

Creation of 3D Models - Wire Frame, Surface, Solid modeling Techniques Using CAD Packages – CSG, B-Rep Approaches in Solid Modeling - Feature Based Modeling Technique – Assembly – Detailing - Exposure to Industrial Components – Application of GD&T

**STL File Generation – Reverse Engineering**

**Manual CNC Part Programming**

Manual CNC Part Programming Using Standard G and M Codes - Tool Path Simulation – Exposure to Various Standard Control Systems- Machining simple components by Using CNC machines.

**Computer Aided Part Programming**

CL Data Generation by Using CAM Software– Post Process Generation for Different Control System – Machining of Computer Generated Part Program by Using Machining Center and Turning Center.

**Study of Experiments**

Multi-axial Machining in CNC Machining Center –EDM – EDM Wire Cut - Rapid Prototyping

**TOTAL: 45 PERIODS**



**UNIT V BODY MATERIALS, TRIM AND MECHANISMS****9**

Steel sheet, timber, plastics, GRP, properties of materials – Corrosion – Anticorrosion methods – Selection of paint – Modern painting process in details – Body trim items – Body mechanisms.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Powloski,J., Vehicle Body Engineering, Business Books Ltd., 1989.
2. John Fenton, Vehicle Body layout and analysis, Mechanical Engg. Publication Ltd., London, 1982.

**REFERENCES:**

1. Giles,G.J., Body construction and design, Illiffe Books Butterworth & Co., 1971.
2. Braithwaite,J.B., Vehicle Body building and drawing, Heinemann Educational Books Ltd., London, 1977.
3. Dieler Anselm., The passenger car body, SAE International, 2000

**AT2452****COMPREHENSION  
(Common to all branches)****L T P C  
0 0 2 1****OBJECTIVE**

The objective of comprehension is to provide opportunity for the student to apply the knowledge acquired during the earlier semesters to real life problems which he/she may have to face in future as an engineer. While learning as how to solve the real life problems, student will receive guidance from the faculty and also review various courses learnt earlier.

**AT 2453****PROJECT WORK  
(Common to all Branches)****L T P C  
0 0 12 6****OBJECTIVES**

- The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
- Each student shall finally produce a comprehensive report covering back round information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.



**AT 2021**

**AUTOMOTIVE AIR-CONDITIONING**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

At the end of the course, the students will be able to understand the components of the automotive air-conditioning and their functions and the latest developments in this field.

**UNIT I AIR CONDITIONING FUNDAMENTALS**

**9**

Basic air conditioning system - location of air conditioning components in a car, schematic layout of a refrigeration system, compressor components, condenser and high pressure service ports, thermostatic expansion valve, expansion valve calibration, controlling evaporator temperature, evaporator pressure regulator, evaporator temperature regulator.

**UNIT II AIR CONDITIONER – HEATING SYSTEM**

**9**

Automotive heaters, manually controlled air conditioner, heater system, automatically controlled air conditioner and heater systems, automatic temperature control, air conditioning protection, engine protection.

**UNIT III REFRIGERANT**

**9**

Containers handling refrigerants, tapping into the refrigerant container, refrigeration system diagnosis, diagnostic procedure, ambient conditions affecting system pressures.

**UNIT IV AIR ROUTING AND TEMPERATURE CONTROL**

**9**

Objectives, evaporator airflow through the recirculating unit, automatic temperature control, duct system, controlling flow, vacuum reserve, testing the air control and handling systems.

**UNIT V AIR CONDITIONING SERVICE**

**9**

Air conditioner maintenance and service, servicing heater system removing and replacing components, trouble shooting of air controlling system, compressor service.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. William H. Crouse and Donald I. Anglin - "Automotive Air conditioning" - McGraw Hill Inc. - 1990.
2. Boyce H.DWiggins - "Automotive Air Conditioning" - Delmar – 2002

**REFERENCES**

1. Mitchell information Services, Inc - "Mitchell Automatic Heating and Air Conditioning Systems" - Prentice Hall Ind. - 1989.
2. Paul Weiser - "Automotive Air Conditioning" - Reston Publishing Co., Inc., - 1990.
3. MacDonald, K.I., - "Automotive Air Conditioning" - Theodore Audel series - 1978
4. Goings.L.F. – "Automotive Air Conditioning" - American Technical services - 1974.

**OBJECTIVES**

At the end of the course, the student will be able to acquire knowledge of alternate fuels and the changes in the engine design for handling them and understand various energy systems for use in the automobiles.

**UNIT I INTRODUCTION****9**

Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternate energy sources. Like EV, hybrid, fuel cell and solar cars.

**UNIT II ALCOHOLS****9**

Properties as engine fuel, alcohols and gasoline blends, performance in SI engine, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI & CI Engines.

**UNIT III NATURAL GAS, LPG, HYDROGEN AND BIOGAS****9**

Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG using LPG in SI & CI engines, performance and emission of LPG. Hydrogen; storage and handling, performance and safety aspects.

**UNIT IV VEGETABLE OILS****9**

Various vegetable oils for engines, esterification, performance in engines, performance and emission characteristics, bio diesel and its characteristics

**UNIT V ELECTRIC, HYBRID, FUEL CELL AND SOLAR CARS****9**

Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar powered vehicles.

**TOTAL: 45 PERIODS****TEXT BOOK**

1. Richard.L.Bechfold – Alternative Fuels Guide Book - SAE International Warrendale - 1997.
2. Maheswar Dayal - "Energy today & tomorrow" - I & B Horishr India - 1982.

**REFERENCES**

1. Nagpal - "Power Plant Engineering" - Khanna Publishers - 1991.
2. "Alcohols as motor fuels progress in technology" - Series No.19 - SAE Publication USE - 1980.
3. SAE paper nos. 840367, 841333, 841334, 841156, Transactions, SAE, USA.

**OBJECTIVES**

The students will be able to understand the sources of vibration, noise and harshness in automobiles and make design modifications to reduce them and improve the life of the components and the comfort of the passengers

**UNIT I BASICS OF VIBRATION 10**

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

**UNIT II VIBRATION CONTROL TECHNIQUES 10**

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers

**UNIT III BASICS OF NOISE AND SOURCES 10**

Introduction, , noise dose level, legislation, measurement and analysis of noise in engines, Noise characteristics, overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

**UNIT IV NOISE CONTROL 9**

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

**UNIT V HARSHNESS AND ITS CONTROL 6**

Harshness, sources.its effects,..measurement and control

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Singiresu S.Rao - "Mechanical Vibrations" - Pearson Education, ISBN –81-297-0179-0 - 2004.
2. Rao V. Dukkipati and J.Srinivas , "Text book of Mechanical Vibrations", Prentice-Hall of India P Ltd, New Delhi. 2004
3. Kewal Pujara "Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.

**REFERENCES**

1. Bernard Challen and Rodica Baranescu - "Diesel Engine Reference Book" - Second edition - SAE International - ISBN 0-7680-0403-9 – 1999.
2. Julian Happian-Smith - "An Introduction to Modern Vehicle Design"- Butterworth-Heinemann, ISBN 0750-5044-3 - 2004
3. John Fenton - "Handbook of Automotive body Construction and Design Analysis - Professional Engineering Publishing, ISBN 1-86058-073- 1998.

**OBJECTIVE:**

- To explain the theory of combustion processes in SI and CI .Engines and the gas exchange processes and the various possible alternate fuels and the developments in the recent years in this area.

**UNIT I COMBUSTION IN SI ENGINES 9**

Stages of combustion - ignition, flame propagation, factors affecting flame structure and speed, cycle by cycle variations, misfire, knock and pre-ignition. Factors controlling combustion chamber design. Combustion in diesel engines, comparison of different combustion systems, fuel spray structure and factors affecting it. Models for combustion in SI and CI engines.

**UNIT II GAS EXCHANGE PROCESSES 9**

Gas exchange processes in two and four stroke engines, factors affecting volumetric efficiency, flow through valves and ports, multi valve concept. Charge motion within the cylinder. Turbocharging and Turbocharger control. Different methods of charging and scavenging two stroke engines.

**UNIT III COMBUSTION ANALYSIS 9**

Introduction to HWA, LDA and PIV systems to analyse engine flows. Engine heat transfer and energy balance, correlations for heat transfer coefficient, variables affecting heat transfer in engines. Cylinder pressure data acquisition and thermodynamic analysis of engine pressure data to yield heat release rates.

**UNIT IV ALTERNATIVE FUELS 9**

Alternative gaseous and liquid fuels for SI and CI engines, Alcohols, Biogas, LPG, CNG, Hydrogen, Biodiesel and Straight Vegetable oils, their properties and characteristics when used as engine fuels. Production, storage and distribution of different alternative fuels.

**UNIT V RECENT DEVELOPMENTS 9**

Homogeneous charge compression ignition, Stratified charge and gasoline direct injection, Dual fuel, lean burn and Hot surface Ignition engine concepts. Hybrid Electric Drives.

**TOTAL: 45 PERIODS****TEXT BOOKS:**

- Internal Combustion Engines by V. Ganesan, 2007, Tata Mc Graw Hill
- Internal Combustion Engine Fundamentals, John B Heywood, Mc Graw Hill
- Advanced Engine Technology by Heisler, SAE Publication

**REFERENCES:**

- Internal Combustion Engines by Richard Stone, Macmillan Book Company also SAE Publications
- Internal Combustion Engines by Colin R Ferguson, John Wiley and Sons
- Design and Simulation of Two Stroke Engines, GP Blair SAE Publications



3. Grant, Eugene .L “Statistical Quality Control”, McGraw-Hill, 1996
4. Monohar Mahajan, “Statistical Quality Control”, Dhanpat Rai & Sons, 2001.
5. R.C.Gupta, “Statistical Quality control”, Khanna Publishers, 1997.
6. Besterfield D.H., “Quality Control”, Prentice Hall, 1993.
7. Sharma S.C., “Inspection Quality Control and Reliability”, Khanna Publishers, 1998.
8. Danny Samson, “Manufacturing & Operations Strategy”, Prentice Hall, 1991

**AT2037**

**METROLOGY AND INSTRUMENTATION**

**L T P C**  
**3 0 0 3**

**OBJECTIVE**

Study of the theory, construction and operation of different measurement technology, instruments transducers and their application

**UNIT I LINEAR MEASUREMENT**

**9**

Units and standards, precision, accuracy and measurement errors. Linear measuring instruments, dial gauges, comparators and linear measuring machines. Angular measuring instruments- measurement of straightness flatness and surface finish. Profilographs.

**UNIT II PRESSURE MEASUREMENT**

**9**

Bourden tube, diaphragm, bellows and pressure capsules: Transducers used in pressure measurement- potentiometer, strain gauges, LVDT, capacitive and variable reluctance type transducers. Dynamic pressure measurement piezo electric and piezo resistive transducers. Farnboro engine indicator. Low pressure measurement McLeod gauge, Pirani gauge,, thermal conductivity type pressure measurement.

**UNIT III FLOW MEASUREMENT**

**9**

Obstruction type flow meter- orifice plate, venturimeter, flow nozzles, pitot tube, rotometer. Positive displacement flow meters – turbine flow meter, fluted tube flowmeter, anemometer, ultrasonic flow meter, magnetic flow meters. Alcock viscous air flow meter.

**UNIT IV TEMPERATURE MEASUREMENT:**

**9**

Temperature scales – mechanical temperature sensors, liquid in glass, vapour pressure, bimetal temperature gauges. Resistance type temperature sensors. Thermistors, thermocouples, Laws of thermocouple, types of thermocouples. Construction and circuits for thermocouples. High temperature measurement pyrometers.

**UNIT V FORCE AND TORQUE MEASUREMENT:**

**9**

Force measuring devices- Balances, platform scales, weigh bridges, load cells, proving ring. Torque measurement – prony brake, rope brake and fan type brakes. Dynamometers – hydraulic, electric cardle and eddy current dynamometers. Transmission dynamometers. Chassis dynamometers.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**



## REFERENCES

1. Obert, E.F., Internal Combustion Engines and Air Pollution, Intext Educational Publishers, 1980.
2. Richard Stone, Internal Combustion Engines, SAE, 1992.
3. Vincent, E.T., Supercharging the I.C. Engines, McGraw-Hill. 1943
4. Schweitzer, P.H., Scavenging of Two Stroke Cycle Diesel Engine, MacMillan Co., 1956

**AT2027**

**AUTOMOTIVE AERODYNAMICS**

**L T P C**  
**3 0 0 3**

## OBJECTIVE

- To make the students understand the design concept of automobile bodies and to determine their drag coefficients and optimize their shapes. The use of wind tunnel for the same will be illustrated.

## UNIT I INTRODUCTION

**9**

Scope – historical development trends – Fundamentals of fluid mechanics – Flow phenomenon related to vehicles – External & Internal flow problems.. – Resistance to vehicle motion – Performance – Fuel consumption and performance – Potential of vehicle aerodynamics.

## UNIT II AERODYNAMIC DRAG OF CABS

**9**

Car as a bluff body – Flow field around car – drag force – types of drag force – analysis of aerodynamic drag – drag coefficient of cars – strategies for aerodynamic development – low drag profiles.

## UNIT III SHAPE OPTIMIZATION OF CABS

**9**

Front and modification – front and rear wind shield angle – Boat tailing – Hatch back, fast back and square back – Dust flow patterns at the rear – Effect of gap configuration – effect of fasteners.

## UNIT IV VEHICLE HANDLING

**9**

The origin of force and moments on a vehicle – side wind problems – methods to calculate forces and moments – vehicle dynamics Under side winds – the effects of forces and moments – Characteristics of forces and moments – Dirt accumulation on the vehicle – wind noise – drag reduction in commercial vehicles.

## UNIT V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS

**9**

Introduction – Principles of wind tunnel technology – Limitation of simulation – Stress with scale models – full scale wind tunnels – measurement techniques – Equipment and transducers – road testing methods – Numerical methods.

**TOTAL: 45 PERIODS**

## TEXT BOOK :

1. Hucho, W.H., Aerodynamics of Road vehicles, Butterworths Co. Ltd., 1987.

2. Pope, A., Wind Tunnel Testing, John Wiley & Sons, 2nd Edn., New York, 1974.

**REFERENCES :**

1. Automotive Aerodynamics: Update SP-706, SAE, 1987.
2. Vehicle Aerodynamics, SP-1145, SAE, 1996.

**ME2030**

**COMPOSITE MATERIALS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the fundamentals of composite material strength and its mechanical behavior
- Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
- Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
- Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

**UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING**

**12**

Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke’s Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix ( $Q_{ij}$ ), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding – Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes

**UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS**

**10**

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

**UNIT III LAMINA STRENGTH ANALYSIS**

**5**

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill’s Criterion for Anisotropic materials. Tsai-Hill’s Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

**UNIT IV THERMAL ANALYSIS**

**8**

Assumption of Constant C.T.E’s. Modification of Hooke’s Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E’s. C.T.E’s for special Laminate

Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

**UNIT V ANALYSIS OF LAMINATED FLAT PLATES** **10**  
Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

**TOTAL: 45 PERIODS**

**TEXT BOOK:**

1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994, Second Edition - CRC press in progress.
2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw-Hill, 1998

**REFERENCES:**

1. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press-2006, First Indian Edition – 2007
2. Mallick, P.K., Fiber –"Reinforced Composites: Materials, Manufacturing and Design", Maneel Dekker Inc, 1993.
3. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co.,1984.
4. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
5. Mallick, P.K. and Newman, S., (edition), "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munish, 1990.

**ME2029 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the functions and design principles of Jigs, fixtures and press tools
- To gain proficiency in the development of required views of the final design.

**UNIT I LOCATING AND CLAMPING PRINCIPLES:** **8**

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

**UNIT II JIGS AND FIXTURES** **10**

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

**UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES**

**10**

Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

**UNIT IV BENDING FORMING AND DRAWING DIES**

**10**

Difference between bending, forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing reverse re-drawing and combination dies – Blank development for ax- symmetric, rectangular and elliptic parts – Single and double action dies.

**UNIT V MISCELLANEOUS TOPICS**

**7**

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke - Course should be supplemented with visits to industries. (Use of Approved design Data Book permitted).

**TEXT BOOKS**

1. Joshi, P.H. “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.
2. Donaldson, Lecain and Goold “Tool Design”, III rd Edition Tata McGraw Hill, 2000.

**REFERENCES:**

1. K. Venkataraman, “Design of Jigs Fixtures & Press Tools”, Tata McGraw Hill, New Delhi, 2005.Kempster, “Jigs and Fixture Design”, Hoddes and Stoughton – Third Edition 1974.
2. Joshi, P.H. “Press Tools” – Design and Construction”, Wheels publishing, 1996.
3. Hoffman “Jigs and Fixture Design” – Thomson Delmar Learning, Singapore, 2004.
4. ASTME Fundamentals of Tool Design Prentice Hall of India.
5. Design Data Hand Book, PSG College of Technology, Coimbatore.

**AT2028**

**COMPUTER SIMULATION OF I.C. ENGINES**

**L T P C  
3 0 0 3**

**OBJECTIVE**

- To make the students understand the basic principles of simulation of the combustion processes in engines used for automobiles and the heat transfer mechanism and friction losses of the different systems.

- UNIT I COMBUSTION CALCULATIONS 9**  
Heat of reaction at constant volume and constant pressure, Calculation of properties of the working medium in an engine, Constant volume and constant pressure adiabatic combustion, Calculation of Adiabatic flame temperature.
- UNIT II SIMULATION OF SI ENGINE COMBUSTION 9**  
Engine kinematics, Ideal Otto cycle, SI engine simulation with adiabatic combustion with air as the working substance under full and part throttle conditions. Actual SI engine heat release rate curves. SI engine combustion models including Wiebe's function
- UNIT III SIMULATION OF CI ENGINE COMBUSTION 9**  
CI engine simulation with adiabatic combustion with air as the working substance under naturally aspirated, supercharged and turbocharged conditions. Actual heat release rates of diesel engines, Hardenberg and Hase and other ignition delay models for diesel engines, Zero dimensional combustion models for CI engines – Watsons and White House and Way models.
- UNIT IV GAS EXCHANGE PROCESSES 9**  
Flow through valves their characteristics, compressible and incompressible flow through valves, volumetric efficiency and Mach index, Effect of valve timing on volumetric efficiency, Swirl and squish, SI engine simulation with gas exchange, influence of valve timing and area. CI engine simulation with gas exchange.
- UNIT V HEAT TRANSFER AND FRICTION IN ENGINES 9**  
Engine friction variation, models for engine friction, Heat transfer mechanisms in engines, Models for heat transfer in engines. Two stroke engine scavenging parameters like delivery ratio, scavenging efficiency, trapping efficiency. Perfect displacement and perfect mixing models for scavenging.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Computer simulation of compression ignition engine processes by V. Ganesan, Universities Press, 2000.
2. Computer simulation of Spark Ignition Engine Processes by V Ganesan, Universities Press, 2000
3. Introduction to Internal Combustion Engines by Richard Stone:

**REFERENCES:**

1. Internal Combustion Engines – Applied Thermo Sciences, Colin R Ferguson, John Wiley and Sons.
2. Internal Combustion Engine Fundamentals, John B Heywood, Mc Graw Hill

**OBJECTIVES**

To understand the basic concepts associated with the design and functioning and applications of Robots

To study about the drives and sensors used in Robots

To learn about analyzing robot kinematics and robot programming

**UNIT I FUNDAMENTALS OF ROBOT****7**

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Functions – Need for Robots – Different Applications

**UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS****10**

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of Drives End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

**UNIT III SENSORS AND MACHINE VISION****10**

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction: Edge detection, Segmentation Feature Extraction and Object Recognition - Algorithms. Applications – Inspection, Identification, Visual Servicing and Navigation.

**UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING****10**

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs

**UNIT V IMPLEMENTATION AND ROBOT ECONOMICS****8**

RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

**TOTAL: 45 PERIODS**

## TEXT BOOK

1. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2001

## REFERENCES

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 1987
2. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992
3. Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw-Hill, 1995

**AT2029**

**NEW GENERATION AND HYBRID VEHICLES**

**L T P C**  
**3 0 0 3**

## OBJECTIVE

- To illustrate the new generation vehicles and their operation and controls

### UNIT I INTRODUCTION

**7**

Electric and hybrid vehicles, flexible fuel vehicles (FFV), solar powered vehicles, magnetic track vehicles, fuel cells vehicles.

### UNIT II POWER SYSTRM AND NEW GENERATION VEHICLES

**12**

Hybrid Vehicle engines, Stratified charge engines, learn burn engines, low heat rejection engines, hydrogen engines, HCCI engine, VCR engine, surface ignition engines, VVTI engines. High energy and power density batteries, fuel cells, solar panels, flexible fuel systems.

### UNIT III VEHICLE OPERATION AND CONTROL

**9**

Computer Control for pollution and noise control and for fuel economy - Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

### UNIT IV VEHICLE AUTOMATED TRACKS

**9**

Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel, GPS.

### UNIT V SUSPENSION, BRAKES, AERODYNAMICS AND SAFETY

**8**

Air suspension – Closed loop suspension, compensated suspension, anti skid braking system, retarders, regenerative braking, safety gauge air backs- crash resistance. Aerodynamics for modern vehicles, safety systems, materials and standards.

**TOTAL: 45 PERIODS**

## TEXT BOOKS

1. Modern Vehicle Technology by Heinz.
2. Bosch Hand Book, SAE Publication,, 2000

## REFERENCES

1. Light weight electric for hybrid vehicle design.
2. Advance hybrid vehicle power transmission, SAE.





order level-ABC analysis-statistical methods in inventory control-inventory classification methods.

Store keeping and warehouse management-objectives-functions-store keeper-duties-responsibilities-location of store-stores ledger.Cost control& cost reduction programmes.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. B.B. Goel-Project Management-Deep and Deep Publications, New Delhi,2004
2. Choudhury-S. Project Management –TaTa Mc Graw –Hill- Publishing Company Limited, New Delhi,2005
3. Datta.A.K. Integrated Material Management
4. Gopalakrishnan.P. and Sthuram. M. Material management-An integral Approach
5. M.V.Varma –Material Management

**REFERENCES:**

1. Mattin.C.C. Project Management-American Management Association, New York,1976
2. Denis Lock-Project Management-Coles Publishing company,1980

**AT2032 ENGINE AUXILLARY SYSTEMS L T P C**  
**3 0 0 3**

**OBJECTIVE**

- To make the students understand the various auxiliary systems used in automobiles and their functions

**UNIT I CARBURETION 10**

Properties of air-petrol mixtures, Mixture requirements for steady state and transient operation, Mixture formation studies of volatile fuels, design of elementary carburetor, Chokes, Effects of altitude on carburetion, Carburetor for 2-stroke and 4-stroke engines, carburetor systems for emission control.

**UNIT II GASOLINE INJECTION AND IGNITION SYSTEMS 9**

Petrol Injection, Pneumatic and Electronic Fuel Injection Systems types. Ignition system requirements, Timing, Ignition Systems, breaker mechanism and spark plugs, Factors affecting energy requirement of the ignition system, factors affecting spark plug operation, Electronic Ignition Systems.

**UNIT III DIESEL FUEL INJECTION 9**

Factors influencing fuel spray atomization, penetration and dispersion of diesel and heavy oils and their properties, rate and duration of injection, fuel line hydraulics, fuel pump, injectors, CRDI systems and its merits and demerits.

**UNIT IV MANIFOLDS AND MIXTURE DISTRIBUTION 9**

Intake system components, Discharge coefficient, Pressure drop, Air filter, Intake manifold, Connecting pipe, Exhaust system components, Exhaust manifold and exhaust pipe, Spark arresters, Waste heat recovery, Exhaust mufflers, Type of mufflers,

exhaust manifold expansion.

**UNIT V LUBRICATION AND COOLING SYSTEMS 8**

Lubricants, lubricating systems, Lubrication of piston rings, bearings, oil consumption, Oil cooling. Heat transfer coefficients, liquid and air cooled engines, coolants, additives and lubricity improvers, concept of adiabatic engines.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Ramalingam, K.K, Internal Combustion Engine, Scitech Publication (India)
2. Ganesan, V., Internal Combustion Engines, Tata McGraw-Hill Book Co., 1995.

**REFERENCES**

1. Domkundwar, V.M, A Course in Internal Combustion Engines, Dhanpat Rai and Co., 1999.
2. Mathur, M.L., and Sharma, R.P., A Course in Internal Combustion Engines, Dhanpat Rai Publications (P) Ltd., 1998.
3. Duffy Smith, Auto Fuel Systems, The Good Heart Willcox Company Inc., Publishers, 1987.
4. Edward F, Obert, Internal Combustion Engines and Air Pollution, Intext Education Publishers, 1980.

<b>MG2021</b>	<b>MARKETING MANAGEMENT</b>	<b>L T P C</b>
	<i>(Common to Mechanical, Production and Mechatronics)</i>	<b>3 0 0 3</b>

**OBJECTIVE**

- To understand the various processes involved in Marketing and its Philosophy.
- To learn the Psychology of consumers.
- To formulate strategies for advertising, pricing and selling

**UNIT I MARKETING PROCESS 9**

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

**UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9**

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psycho graphic and geographic segmentation, process, patterns.

**UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9**

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

**UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9**

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

**UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9**

Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Govindarajan. M, "Marketing management – concepts, cases, challenges and trends", Prentice hall of India, second edition 2007.
2. Philip Kotler, Koshy Jha "Marketing Management", Pearson Education ,Indian adapted edition.2007

**REFERENCES**

1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context", 1990.
2. Czinkota&Kotabe, "Marketing management", Thomson learning, Indian edition 2007
3. Adrain palmer, " Introduction to marketing theory and practice", Oxford university press IE 2004.
4. Donald S. Tull and Hawkins, "Marketing Reasearch", Prentice Hall of Inida-1997.
5. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000.
6. Steven J.Skinner, "Marketing", All India Publishers and Distributes Ltd. 1998.
7. Graeme Drummond and John Ensor, Introduction to marketing concepts, Elsevier, Indian Reprint, 2007

**ME2035 ENTREPRENEURSHIP DEVELOPMENT L T P C**  
(Common to MECHANICAL, PRODUCTION & AUTOMOBILE) **3 0 0 3**

**OBJECTIVE**

- Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

**UNIT I ENTREPRENEURSHIP 9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

**UNIT II MOTIVATION 9**

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

**UNIT III BUSINESS 9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

**UNIT IV FINANCING AND ACCOUNTING 9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

**UNIT V SUPPORT TO ENTREPRENEURS 9**

Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. S.S.Khanka “Entrepreneurial Development” S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.
2. Kuratko & Hodgetts, “Enterprenuership – Theory, process and practices”, Thomson learning 6<sup>th</sup> edition.

**REFERENCES**

1. Hisrich R D and Peters M P, “Entrepreneurship” 5<sup>th</sup> Edition Tata McGraw-Hill, 2002.
2. Mathew J Manimala,” Enterprenuership theory at cross roads: paradigms and praxis” Dream tech 2<sup>nd</sup> edition 2006.
3. Rabindra N. Kanungo “Entrepreneurship and innovation”, Sage Publications, New Delhi, 1998.
4. EDII “ Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development” Institute of India, Ahmadabad, 1986.

**AT2033**

**AUTOMOTIVE SAFETY**

**L T P C  
3 0 0 3**

**OBJECTIVE:**

- At the end, the students will have good exposure to automotive safety aspects including the understanding of the various safety equipments.

**UNIT I INTRODUCTION 9**

Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone, safety sandwich construction.

**UNIT II SAFETY CONCEPTS 9**

Active safety: driving safety, conditional safety, perceptibility safety, operating safety-  
passive safety: exterior safety, interior safety, deformation behaviour of vehicle body,  
speed and acceleration characteristics of passenger compartment on impact.

**UNIT III SAFETY EQUIPMENTS 9**

Seat belt, regulations, automatic seat belt tightener system, collapsible steering column,  
tiltable steering wheel, air bags, electronic system for activating air bags, bumper design  
for safety.

**UNIT IV COLLISION WARNING AND AVOIDANCE 9**

Collision warning system, causes of rear end collision, frontal object detection, rear  
vehicle object detection system, object detection system with braking system  
interactions.

**UNIT V COMFORT AND CONVENIENCE SYSTEM 9**

Steering and mirror adjustment, central locking system , Garage door opening system,  
tyre pressure control system, rain sensor system, environment information system

**TOTAL: 45 PERIODS**

**TEXT BOOK**

1. Bosch - "Automotive Handbook" - 5<sup>th</sup> edition - SAE publication - 2000.
2. J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.

**REFERENCE**

1. Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-  
Hill Inc., - 1999.

**AT2034**

**FUEL CELLS TECHNOLOGY**

**L T P C  
3 0 0 3**

**OBJECTIVE**

- To introduce the concept of fuel cells for use in automobiles, analyse the  
performance characteristics of the various components and compare them with the  
other powering devices

**UNIT I INTRODUCTION TO FUEL CELLS 9**

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

**UNIT II FUEL CELLS FOR AUTOMOTIVE APPLICATIONS 9**

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

**UNIT III FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE 9**

Fuel cell performance characteristics – current/voltage, voltage efficiency and power density, ohmic resistance, kinetic performance, mass transfer effects – membrane electrode assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates.

**UNIT IV FUELING 9**

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

**UNIT V FUEL CYCLE ANALYSIS 9**

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

**TOTAL: 45 PERIODS**

**TEXTBOOKS**

1. Fuel Cells for automotive applications – professional engineering publishing UK. ISBN 1-86058 4233, 2004.
2. Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press ISBN 0-8493-0877-1-2003.

**ME2038 OPERATIONS RESEARCH L T P C**  
**(Common to Mechanical, Metallurgy, Automobile and Mechatronics 3 0 0 3**  
**– VI semester Elective)**

**OBJECTIVE**

To create awareness about optimization in utilization of resources.

To understand and apply operations research techniques to industrial operations.

**UNIT I LINEAR MODEL 10**

The phases of OR study – formation of an L.P model- graphical solution – simplex algorithm – artificial variables technique– Big M method, two phase method, Duality in LPP. Transportation problems- VAM – MODI technique, Assignment problems.

**UNIT II NETWORK MODELS 8**

Shortest route – minimal spanning tree - maximum flow models – project network- CPM and PERT network-critical path scheduling.

**UNIT III INVENTORY MODEL 9**

Types of Inventory- EOQ –ERL- Deterministic inventory problems – Price breaks - Stochastic inventory problems- selective inventory control techniques.

**UNIT IV REPLACEMENT MODELS 9**

Replacement of items that deteriorate with time – value of money changing with time – not charging with time – optimum replacement policy – individual and group replacement. Sequencing problem: models with n jobs with 2 machines – problem with n jobs with m machines.

**UNIT V QUEUING THEORY 9**

Queuing models – queuing systems and structures – notation –parameter – single server and multiserver models – Poisson input – exponential service – constant rate service – infinite population.

**TOTAL: 45 PERIODS**

**TEXT BOOK**

1. Wayne.L.Winston, Operations research applications and algorithms, Thomson learning,4<sup>th</sup> edition 2007.
2. Taha H.A, “Operation Research”, Pearson Education sixth edition, 2003

**REFERENCES**

1. Frederick.S.Hiller and Gerald.J.Lieberman, “Operations research concepts and cases”, TMH (SIE) 8<sup>th</sup> edition.
2. J.K.Sharma, “Operations research theory and applications”, Macmillan India .3<sup>rd</sup> edition 2007,
3. Hira and Gupta “ Problems in Operations Research”, S.Chand and Co,2002.
4. Panneerselvam, “Operations Research” Prentice Hall of India, 2003.
5. G Srinivasan, “Operations research principles and applications”, PHI (EEE) 2007.
6. Wagner, “Operations Research”, Prentice Hall of India, 2000.

**AT 2035**

**TRANSPORT MANAGEMENT**

**L T P C  
3 0 0 3**

**OBJECTIVE**

- After completion of this course the students are able to manage a transport fleet and their related activities for minimizing operational cost.

**UNIT I INTRODUCTION 9**

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

**UNIT II TRANSPORT SYSTEMS 9**

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

**UNIT III SCHEDULING AND FARE STRUCTURE 9**

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

**UNIT IV MOTOR VEHICLE ACT 9**

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

**UNIT V MAINTENANCE 9**

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

**TOTAL: 45 PERIODS**

**TEXTBOOK**

1. John Duke - Fleet Management – McGraw-Hill Co, USA -1984.
2. Kitchin.L.D., - Bus Operation - Illiffee and Sons Co., London, III edition - 1992

**REFERENCES**

1. Government Motor Vehicle Act –Publication on latest act to be used as on date

<b>GE2022</b>	<b>TOTAL QUALITY MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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**UNIT I INTRODUCTION 9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

**UNIT II TQM PRINCIPLES 9**

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS & TECHNIQUES I 9**

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

**UNIT IV TQM TOOLS & TECHNIQUES II****9**

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

**UNIT V QUALITY SYSTEMS****9**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

**TOTAL: 45 PERIODS****TEXT BOOK**

1. Dale H.Besterfield, et al., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

**REFERENCES**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6<sup>th</sup> Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3<sup>rd</sup> Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. L