

**ANNA UNIVERSITY, CHENNAI**

**AFFILIATED INSTITUTIONS**

**R - 2013**

**B.E. AUTOMOBILE ENGINEERING**

**I – VIII SEMESTERS CURRICULUM AND SYLLABUS**

**SEMESTER I**

<b>SL. No.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>						
1.	HS6151	<u>Technical English – I</u>	3	1	0	4
2.	MA6151	<u>Mathematics – I</u>	3	1	0	4
3.	PH6151	<u>Engineering Physics – I</u>	3	0	0	3
4.	CY6151	<u>Engineering Chemistry – I</u>	3	0	0	3
5.	GE6151	<u>Computer Programming</u>	3	0	0	3
6.	GE6152	<u>Engineering Graphics</u>	2	0	3	4
<b>PRACTICALS</b>						
7.	GE6161	<u>Computer Practices Laboratory</u>	0	0	3	2
8.	GE6162	<u>Engineering Practices Laboratory</u>	0	0	3	2
9.	GE6163	<u>Physics and Chemistry Laboratory - I</u>	0	0	2	1
<b>TOTAL</b>			<b>17</b>	<b>2</b>	<b>11</b>	<b>26</b>

**SEMESTER II**

<b>SL. No.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>						
1.	HS6251	<u>Technical English – II</u>	3	1	0	4
2.	MA6251	<u>Mathematics – II</u>	3	1	0	4
3.	PH6251	<u>Engineering Physics – II</u>	3	0	0	3
4.	CY6251	<u>Engineering Chemistry – II</u>	3	0	0	3
5.	GE6252	<u>Basic Electrical and Electronics Engineering</u>	4	0	0	4
6.	GE6253	<u>Engineering Mechanics</u>	3	1	0	4
<b>PRACTICALS</b>						
7.	GE6261	<u>Computer Aided Drafting and Modeling Laboratory</u>	0	1	2	2
8.	GE6262	<u>Physics and Chemistry Laboratory - II</u>	0	0	2	1
<b>TOTAL</b>			<b>19</b>	<b>4</b>	<b>4</b>	<b>25</b>

### SEMESTER III

SL. NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	MA6351	Transforms and Partial Differential Equations	3	1	0	4
2	ME6301	Engineering Thermodynamics	3	0	0	3
3	CE6451	Fluid Mechanics and Machinery	3	0	0	3
4	AT6301	Automotive Engines	3	0	0	3
5	AT6302	Mechanics of Machines	3	1	0	4
6	ME6352	Manufacturing Technology	3	0	0	3
<b>PRACTICAL</b>						
7	AT6311	Automotive Components Laboratory	0	0	3	2
8	CE6461	Fluid Mechanics and Machinery Laboratory	0	0	3	2
9	ME6465	Manufacturing Technology Laboratory	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>2</b>	<b>9</b>	<b>26</b>

### SEMESTER IV

SL. NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	MA6452	Statistics and Numerical Methods	3	1	0	4
2	AT6401	Applied Thermodynamics and Heat Transfer	3	1	0	4
3	ME6403	Engineering Materials and Metallurgy	3	0	0	3
4	CE6306	Strength of Materials	3	1	0	4
5	EC6464	Electronics and Microprocessors	3	0	0	3
6	AT6402	Automotive Chassis	3	0	0	3
<b>PRACTICAL</b>						
7	PR6412	Computer Aided Machine Drawing Laboratory	0	0	3	2
8	EC6466	Electronics and Microprocessors Laboratory	0	0	3	2
9	CE6315	Strength of Materials Laboratory	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>3</b>	<b>9</b>	<b>27</b>

### SEMESTER V

SL. NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	GE6351	Environmental Science and Engineering	3	0	0	3
2	ME6503	Design of Machine Elements	3	0	0	3
3	AT6501	Automotive Transmission	3	0	0	3
4	AT6502	Automotive Electrical and Electronics System	3	0	0	3
5	AT6503	Vehicle Design Data Characteristics	3	0	0	3
6	AT6504	Automotive Fuels and Lubricants	3	0	0	3
<b>PRACTICAL</b>						
7	GE6563	Communication Skills - Laboratory Based	0	0	4	2
8	AT6511	Automotive Electrical and Electronics Laboratory	0	0	3	2
9	AT6512	Automotive Fuels and Lubricants Laboratory	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>10</b>	<b>24</b>

### SEMESTER VI

SL. NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	MG6851	Principles of Management	3	0	0	3
2	AT6601	Automotive Engine Components Design	3	0	0	3
3	AT6602	Automotive Chassis Components Design	3	0	0	3
4	AT6603	Two and Three Wheelers	3	0	0	3
5	AT6604	Vehicle Dynamics	3	0	0	3
6		Elective – I	3	0	0	3
<b>PRACTICAL</b>						
7	AT6611	Computer Aided Engine and Chassis Design Laboratory	0	0	3	2
8	AT6612	Two and Three Wheelers Laboratory	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>6</b>	<b>22</b>

### SEMESTER VII

SL. NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	AT6701	Engine and Vehicle Management System	4	0	0	4
2	ME6603	Finite Element Analysis	3	0	0	3
3	AT6702	Vehicle Maintenance	3	0	0	3
4	AT6703	Automotive Pollution and Control	3	0	0	3
5		Elective – II	3	0	0	3
6		Elective – III	3	0	0	3
<b>PRACTICAL</b>						
7	AT6711	Engine Performance and Emission Testing Laboratory	0	0	3	2
8	AT6712	Vehicle Maintenance Laboratory	0	0	3	2
<b>TOTAL</b>			<b>19</b>	<b>0</b>	<b>6</b>	<b>23</b>

### SEMESTER VIII

SL. NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	AT6801	Vehicle Body Engineering	3	0	0	3
2		Elective – IV	3	0	0	3
<b>PRACTICAL</b>						
3	AT6811	Project Work	0	0	12	6
<b>TOTAL</b>			<b>6</b>	<b>0</b>	<b>12</b>	<b>12</b>

**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 185**

## ELECTIVES FOR B.E. AUTOMOBILE ENGINEERING

### SEMESTER VI ELECTIVE – I

SL. NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	GE6075	Professional Ethics in Engineering	3	0	0	3
2	AT6001	Automotive Air-Conditioning	3	0	0	3
3	AT6002	Alternative Fuels and Energy System	3	0	0	3
4	AT6003	Noise, Vibration and Harshness	3	0	0	3
5	AT6004	Advance Theory of IC Engines	3	0	0	3
6	AT6005	Metrology and Instrumentation	3	0	0	3

### SEMESTER VII ELECTIVE – II

SL. NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	AT6006	Manufacturing of Automotive Components	3	0	0	3
2	ME6006	Design of Jigs, Fixtures and Press Tools	3	0	0	3
3	ME6010	Robotics	3	0	0	3
4	AT6007	New Generation and Hybrid Vehicles	3	0	0	3
5	AT6008	Computer Simulation of IC Engines	3	0	0	3

### ELECTIVE – III

SL. NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	ME6007	Composite Materials and Mechanics	3	0	0	3
2	AT6009	Automotive Aerodynamics	3	0	0	3
3	AT6010	Off Road Vehicles	3	0	0	3
4	AT6011	Automotive Safety	3	0	0	3
5	AT6012	Engine Auxiliary Systems	3	0	0	3

### SEMESTER VIII ELECTIVE – IV

SL. NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	AT6013	Transport Management	3	0	0	3
2	MG6071	Entrepreneurship Development	3	0	0	3
3	ME6015	Operations Research	3	0	0	3
4	GE6757	Total Quality Management	3	0	0	3

**OBJECTIVES:**

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

**UNIT I****9+3**

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

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

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

**UNIT III****9+3**

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

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

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

## UNIT V

9+3

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

**TOTAL (L:45+T:15): 60 PERIODS**

### OUTCOMES:

Learners should be able to

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- Listen/view and comprehend different spoken discourses/excerpts in different accents

### TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

### REFERENCES:

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011.
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006.
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
5. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008.

### EXTENSIVE Reading (Not for Examination)

1. Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

### WEBSITES:

1. <http://www.usingenglish.com>
2. <http://www.uefap.com>

### TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

## EVALUATION PATTERN:

### Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- ✓ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

### End Semester Examination: 80%

MA6151

MATHEMATICS – I

L T P C  
3 1 0 4

### OBJECTIVES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

### UNIT I MATRICES

9+3

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

### UNIT II SEQUENCES AND SERIES

9+3

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

**UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS 9+3**  
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

**UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3**  
Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

**UNIT V MULTIPLE INTEGRALS 9+3**  
Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics", Volume I, Second Edition, PEARSON Publishing, 2011.

**PH6151**

**ENGINEERING PHYSICS – I**

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

**OBJECTIVES:**

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

**UNIT I CRYSTAL PHYSICS 9**  
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)





**OBJECTIVES:**

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

**UNIT I POLYMER CHEMISTRY****9**

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: T<sub>g</sub>, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

**UNIT II CHEMICAL THERMODYNAMICS****9**

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore(problems).

**UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY****9**

Photochemistry: Laws of photochemistry - Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Intersystem crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

**UNIT IV PHASE RULE AND ALLOYS****9**

Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

**UNIT V NANO CHEMISTRY****9**

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

**TOTAL :45 PERIODS****OUTCOMES:**

- The knowledge gained on polymer chemistry, thermodynamics, spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these

subjects for further learning.

**TEXT BOOKS:**

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

**REFERENCES:**

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R. , Viswanathan N.V. and JayadevSreedhar, "Polymer Science", New Age International P (Ltd.), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

**GE6151**

**COMPUTER PROGRAMMING**

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

**OBJECTIVES:**

**The students should be made to:**

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

**UNIT I INTRODUCTION**

**8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

**UNIT II C PROGRAMMING BASICS**

**10**

Problem formulation – Problem Solving - Introduction to 'C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

**UNIT III ARRAYS AND STRINGS**

**9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

**UNIT IV FUNCTIONS AND POINTERS**

**9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

## UNIT V STRUCTURES AND UNIONS

9

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**At the end of the course, the student should be able to:**

- Design C Programs for problems.
- Write and execute C programs for simple applications.

### TEXTBOOKS:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

### REFERENCES:

1. Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
3. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

**GE6152**

**ENGINEERING GRAPHICS**

**L T P C**  
**2 0 3 4**

### OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

### CONCEPTS AND CONVENTIONS (Not for Examination)

1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

## UNIT I PLANE CURVES AND FREE HAND SKETCHING

5+9

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

## UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES

5+9

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes -

Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

### **UNIT III PROJECTION OF SOLIDS**

**5+9**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

### **UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**

**5+9**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

### **UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS**

**6+9**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

### **COMPUTER AIDED DRAFTING (Demonstration Only)**

**3**

Introduction to drafting packages and demonstration of their use.

**TOTAL: 75 PERIODS**

### **OUTCOMES:**

On Completion of the course the student will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.

### **TEXT BOOK:**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.

### **REFERENCES:**

1. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2<sup>nd</sup> Edition, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
5. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**GE6161****COMPUTER PRACTICES LABORATORY****L T P C  
0 0 3 2****OBJECTIVES:****The student should be made to:**

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

**LIST OF EXPERIMENTS:**

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

**TOTAL : 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C compiler      30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

**OBJECTIVES:**

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)****I CIVIL ENGINEERING PRACTICE****9****Buildings:**

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:  
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- (e) Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE****13****Welding:**

- (a) Preparation of arc welding of butt joints, lap joints and tee joints.
- (b) Gas welding practice

**Basic Machining:**

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

**Sheet Metal Work:**

- (a) Forming & Bending:
- (b) Model making – Trays, funnels, etc.
- (c) Different type of joints.

**Machine assembly practice:**

- (a) Study of centrifugal pump
- (b) Study of air conditioner

**Demonstration on:**

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.

- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

**GROUP B (ELECTRICAL & ELECTRONICS)**

- |            |  |           |
|------------|--|-----------|
| <b>III</b> | <b>ELECTRICAL ENGINEERING PRACTICE</b>   | <b>10</b> |
|            | 1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.  |           |
|            | 2. Fluorescent lamp wiring.  |           |
|            | 3. Stair case wiring   |           |
|            | 4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.   |           |
|            | 5. Measurement of energy using single phase energy meter.  |           |
|            | 6. Measurement of resistance to earth of an electrical equipment.  |           |
| <b>IV</b>  | <b>ELECTRONICS ENGINEERING PRACTICE</b>  | <b>13</b> |
|            | 1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR. |           |
|            | 2. Study of logic gates AND, OR, EOR and NOT.  |           |
|            | 3. Generation of Clock Signal.   |           |
|            | 4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.   |           |
|            | 5. Measurement of ripple factor of HWR and FWR.  |           |

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

**REFERENCES:**

1. Jeyachandran K., Natarajan S. & Balasubramanian S., “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
2. Jeyapooan T., Saravanapandian M. & Pranitha S., “Engineering Practices Lab Manual”, Vikas PUBLISHING House Pvt.Ltd, 2006.
3. Bawa H.S., “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A. & Sarma P.M.M.S., “Workshop Practice”, Sree Sai Publication, 2002.
5. Kannaiah P. & Narayana K.L., “Manual on Workshop Practice”, Scitech Publications, 1999.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**CIVIL**

- |   |          |
|---|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench)  | 15 Nos.  |
| 3. Standard woodworking tools   | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints  | 5 each   |
| 5. Power Tools: (a) Rotary Hammer   | 2 Nos    |
| (b) Demolition Hammer   | 2 Nos    |
| (c) Circular Saw  | 2 Nos    |
| (d) Planer  | 2 Nos    |
| (e) Hand Drilling Machine   | 2 Nos    |
| (f) Jigsaw  | 2 Nos    |



## MECHANICAL

- |   |           |
|---|-----------|
| 1. Arc welding transformer with cables and holders                            | 5 Nos.    |
| 2. Welding booth with exhaust facility  | 5 Nos.    |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets.   |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.    | 2 Nos.    |
| 5. Centre lathe   | 2 Nos.    |
| 6. Hearth furnace, anvil and smithy tools                                     | 2 Sets.   |
| 7. Moulding table, foundry tools  | 2 Sets.   |
| 8. Power Tool: Angle Grinder  | 2 Nos     |
| 9. Study-purpose items: centrifugal pump, air-conditioner                     | One each. |

## ELECTRICAL

- |  |         |
|--|---------|
| 1. Assorted electrical components for house wiring                         | 15 Sets |
| 2. Electrical measuring instruments  | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each |         |
| 4. Megger (250V/500V)  | 1 No.   |
| 5. Power Tools: (a) Range Finder   | 2 Nos   |
| (b) Digital Live-wire detector   | 2 Nos   |

## ELECTRONICS

- |   |         |
|---|---------|
| 1. Soldering guns   | 10 Nos. |
| 2. Assorted electronic components for making circuits                 | 50 Nos. |
| 3. Small PCBs   | 10 Nos. |
| 4. Multimeters  | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply |         |

**GE6163**

**PHYSICS AND CHEMISTRY LABORATORY – I**

**L T P C**  
**0 0 2 1**

### PHYSICS LABORATORY – I

#### OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

#### LIST OF EXPERIMENTS

(Any FIVE Experiments)

- (a) Determination of Wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
- Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
- Determination of wavelength of mercury spectrum – spectrometer grating
- Determination of thermal conductivity of a bad conductor – Lee's Disc method.
- Determination of Young's modulus by Non uniform bending method
- Determination of specific resistance of a given coil of wire – Carey Foster's Bridge

**OUTCOMES:**

- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee's Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster's bridge set up  
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

**CHEMISTRY LABORATORY- I****OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by vacometry.

**LIST OF EXPERIMENTS**

(Any FIVE Experiments)

- 1 Determination of DO content of water sample by Winkler's method.
- 2 Determination of chloride content of water sample by argentometric method.
- 3 Determination of strength of given hydrochloric acid using pH meter.
- 4 Determination of strength of acids in a mixture using conductivity meter.
- 5 Estimation of iron content of the water sample using spectrophotometer.  
(1,10- phenanthroline / thiocyanate method).
- 6 Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
- 7 Conductometric titration of strong acid vs strong base.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**REFERENCES:**

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore 1994.
3. Jeffery G.H., Bassett J., Mendham J. and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

- |                       |   |        |
|-----------------------|---|--------|
| 1. Iodine flask       | - | 30 Nos |
| 2. pH meter           | - | 5 Nos  |
| 3. Conductivity meter | - | 5 Nos  |
| 4. Spectrophotometer  | - | 5 Nos  |
| 5. Ostwald Viscometer | - | 10 Nos |

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (each 30 Nos.)**

**OBJECTIVES:**

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

**UNIT I****9+3**

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emojicons' as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

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

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

**UNIT III****9+3**

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

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

Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on

Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

## **UNIT V**

**9+3**

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

**TOTAL (L:45+T:15): 60 PERIODS**

### **OUTCOMES:**

Learners should be able to

- Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- Write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- Listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

### **TEXTBOOKS:**

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

### **REFERENCES:**

1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008
2. Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011
3. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005
4. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009
5. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007

### **EXTENSIVE Reading (Not for Examination)**

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

### **Websites**

1. <http://www.englishclub.com>
2. <http://owl.english.purdue.edu>

## TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

## EVALUATION PATTERN:

### Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Report
- Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual presentations, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
- ✓ Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

### End Semester Examination: 80%

MA6251

MATHEMATICS – II

L T P C  
3 1 0 4

## OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

## UNIT I VECTOR CALCULUS

9+3

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 II ORDINARY DIFFERENTIAL EQUATIONS 9+3**  
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 III LAPLACE TRANSFORM 9+3**  
Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

**UNIT IV ANALYTIC FUNCTIONS 9+3**  
Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping:  $w = z+k$ ,  $kz$ ,  $1/z$ ,  $z^2$ ,  $e^z$  and bilinear transformation.

**UNIT V COMPLEX INTEGRATION 9+3**  
Complex integration – Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula – Taylor’s and Laurent’s series expansions – Singular points – Residues – Cauchy’s residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, “A Text book of Engineering Mathematics”, Eighth Edition, Laxmi Publications Pvt Ltd.,2011.
2. Grewal. B.S, “Higher Engineering Mathematics”, 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

1. Dass, H.K., and Er. Rajnish Verma, “Higher Engineering Mathematics”, S. Chand Private Ltd., 2011
2. Glyn James, “Advanced Modern Engineering Mathematics”, 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O’Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage learning, 2012.
4. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., “Engineering Mathematics” Volume II, Second Edition, PEARSON Publishing, 2011.

**OBJECTIVES:**

- To enrich the understanding of various types of materials and their applications in engineering and technology.

**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 – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

**UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS****9**

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications

Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High  $T_c$  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 – Clausius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

**UNIT V ADVANCED ENGINEERING MATERIALS****9**

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

**TOTAL: 45 PERIODS****OUTCOMES:**

- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

**TEXT BOOKS:**

- Arumugam M., Materials Science. Anuradha publishers, 2010
- Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

**REFERENCES:**

- Palanisamy P.K. Materials Science. SCITECH Publishers, 2011
- Senthilkumar G. Engineering Physics II. VRB Publishers, 2011
- Mani P. Engineering Physics II. Dhanam Publications, 2011
- Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009

**OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

**UNIT I WATER TECHNOLOGY****9**

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

**UNIT II ELECTROCHEMISTRY AND CORROSION****9**

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types- chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

**UNIT III ENERGY SOURCES****9**

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H<sub>2</sub> -O<sub>2</sub> fuel cell- applications.

**UNIT IV ENGINEERING MATERIALS****9**

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

**UNIT V FUELS AND COMBUSTION****9**

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal-analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking-octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio- ignition temperature- explosive range - flue gas analysis (ORSAT Method).

**TOTAL: 45 PERIODS**



**OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**

1. Vairam S, Kalyani P and SubaRamesh., "Engineering Chemistry"., Wiley India PvtLtd., New Delhi., 2011
2. DaraS.S, UmareS.S. "Engineering Chemistry", S. Chand & Company Ltd., New Delhi , 2010

**REFERENCES:**

- 1 Kannan P. and Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009
2. AshimaSrivastava and Janhavi N N., "Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2010.
3. RenuBapna and Renu Gupta., "Engineering Chemistry", Macmillan India Publisher Ltd., 2010.
4. Pahari A and Chauhan B., "Engineering Chemistry"., Firewall Media., New Delhi., 2010

**GE6252 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING****L T P C**  
**4 0 0 4****OBJECTIVES:**

- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication.

**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****2**

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****OUTCOMES:**

- ability to identify the electrical components explain the characteristics of electrical machines.
- ability to identify electronics components and use of them to design circuits.

**TEXT BOOKS:**

1. Mittle N., “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
2. Sedha R.S., “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.

**GE6253****ENGINEERING MECHANICS****L T P C  
3 1 0 4****OBJECTIVES:**

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

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

Introduction – Units and Dimensions – Laws of Mechanics – Lami’s theorem, Parallelogram and triangular Law of forces — Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

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

Free body diagram – Types of supports –Action and reaction forces –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 – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

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

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids 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 laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

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

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

**TOTAL : 60 PERIODS****OUTCOMES:**

- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

**TEXT BOOKS:**

1. Beer, F.P and Johnston Jr. E.R., “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, 8<sup>th</sup> Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, “Engineering Mechanics”, Oxford University Press (2010)

**REFERENCES:**

1. Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11<sup>th</sup> Edition, Pearson Education 2010.
2. Irving H. Shames and Krishna Mohana Rao. G., “Engineering Mechanics – Statics and Dynamics”, 4<sup>th</sup> Edition, Pearson Education 2006.
3. Meriam J.L. and Kraige L.G., “ Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2”, Third Edition, John Wiley & Sons,1993.
4. Rajasekaran S and Sankarasubramanian G., “Engineering Mechanics Statics and Dynamics”, 3<sup>rd</sup> Edition, Vikas Publishing House Pvt. Ltd., 2005.
5. Bhavikatti, S.S and Rajashekarappa, K.G., “Engineering Mechanics”, New Age International (P) Limited Publishers, 1998.
6. Kumar, K.L., “Engineering Mechanics”, 3<sup>rd</sup> Revised Edition, Tata McGraw-Hill Publishing company, New Delhi 2008.

**GE6261****COMPUTER AIDED DRAFTING AND MODELING LABORATORY****L T P C  
0 1 2 2****OBJECTIVES:**

- To develop skill to use software to create 2D and 3D models.

**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.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- ability to use the software packers for drafting and modeling
- ability to create 2D and 3D models of Engineering Components

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Sl.No	Description of Equipment	Quantity
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.

**GE6262**

**PHYSICS AND CHEMISTRY LABORATORY – II**

**L T P C**  
**0 0 2 1**

**PHYSICS LABORATORY – II**

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

**LIST OF EXPERIMENTS**

**(Any FIVE Experiments)**

1. Determination of Young's modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

**OUTCOMES:**

- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.  
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

## CHEMISTRY LABORATORY - II

### OBJECTIVES:

- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

### LIST OF EXPERIMENTS

#### (Any FIVE Experiments)

- 1 Determination of alkalinity in water sample
- 2 Determination of total, temporary & permanent hardness of water by EDTA method
- 3 Estimation of copper content of the given solution by EDTA method
- 4 Estimation of iron content of the given solution using potentiometer
- 5 Estimation of sodium present in water using flame photometer
- 6 Corrosion experiment – weight loss method
- 7 Conductometric precipitation titration using  $\text{BaCl}_2$  and  $\text{Na}_2\text{SO}_4$
- 8 Determination of CaO in Cement.

**TOTAL: 30 PERIODS**

### OUTCOMES:

- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

### REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York, 2001.
  2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry, LBS Singapore ,1994.
  3. Jeffery G.H, Bassett J., Mendham J. and Denny R.C., "Vogel's Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
  4. Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, McMillan, Madras 1980
- **Laboratory classes on alternate weeks for Physics and Chemistry.**

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- |                       |   |       |
|-----------------------|---|-------|
| 1. Potentiometer      | - | 5 Nos |
| 2. Flame photo meter  | - | 5 Nos |
| 3. Weighing Balance   | - | 5 Nos |
| 4. Conductivity meter | - | 5 Nos |

**Common Apparatus : Pipette, Burette, conical flask, porcelaine tile, dropper (30 Nos each)**

**OBJECTIVES**

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

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

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

**UNIT II 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 III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS****9 + 3**

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

**UNIT IV FOURIER TRANSFORMS****9 + 3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

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

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES**

- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

**TEXT BOOKS:**

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S., "Higher Engineering Mathematics", 42<sup>nd</sup> Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

**REFERENCES:**

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7<sup>th</sup> Edition, Laxmi Publications Pvt Ltd , 2007.

2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8<sup>th</sup> Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Sixth Edition, Tata McGraw Hill Education Pvt Ltd, New Delhi, 2012.
6. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.

**ME6301**

**ENGINEERING THERMODYNAMICS**

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

**OBJECTIVES:**

- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

**UNIT I BASIC CONCEPTS AND FIRST LAW**

**9**

Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach. Path and point functions. Intensive and extensive, total and specific quantities. System and their types. Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work .P-V diagram. Zeroth law of thermodynamics – concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales. First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes.

**UNIT II SECOND LAW AND AVAILABILITY ANALYSIS**

**9**

Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries. Carnot cycle Reversed Carnot cycle, Performance. Clausius inequality. Concept of entropy, T-s diagram, Tds Equations, entropy change for - pure substance, ideal gases - different processes, principle of increase in entropy. Applications of II Law. High and low grade energy. Available and non-available energy of a source and finite body. Energy and irreversibility. Expressions for the energy of a closed system and open systems. Energy balance and entropy generation. Irreversibility. I and II law Efficiency.

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

**9**

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles, Economiser, preheater, Binary and Combined cycles.

**UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS**

**9**

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced properties-.Compressibility factor-.Principle of Corresponding states. -Generalised Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes. Simple Calculations.

**UNIT V GAS MIXTURES AND PSYCHROMETRY****9**

Mole and Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

**TOTAL : 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to apply the Thermodynamic Principles to Mechanical Engineering Application.
- Apply mathematical fundamentals to study the properties of steam, gas and gas mixtures.

**TEXT BOOKS :**

1. Nag.P.K., "Engineering Thermodynamics", 4<sup>th</sup> Edition, Tata McGraw-Hill, New Delhi, 2008.
2. Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, 2012.

**REFERENCES :**

1. Cengel. Y. and MBoles, "Thermodynamics - An Engineering Approach", 7<sup>th</sup> Edition, Tata McGraw Hill, 2010.
2. Holman.J.P., "Thermodynamics", 3rd Edition. McGraw-Hill, 1995.
3. Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2<sup>nd</sup> Edition, Prentice-Hall of India Pvt. Ltd, 2006
4. Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2010.
5. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
6. Van Wylen and Sonntag, "Classical Thermodynamics", Wiley Eastern, 1987
7. Venkatesh,A, "Basic Engineering Thermodynamics", Universities Press (India) Limited, 2007.
8. Kau-Fui Vincent Wong, "Thermodynamics for Engineers", Indian Reprint, CRC Press, 2010.
9. Prasanna Kumar: Thermodynamics "Engineering Thermodynamics" Pearson Education, 2013

**CE6451****FLUID MECHANICS AND MACHINERY****L T P C  
3 0 0 3****OBJECTIVES:**

- The applications of the conservation laws to flow through pipes and hydraulic machines are studied
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

**UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS****8**

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

**UNIT II FLOW THROUGH CIRCULAR CONDUITS****8**

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.



**UNIT III      DIMENSIONAL ANALYSIS****9**

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

**UNIT IV      PUMPS****10**

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

**UNIT V      TURBINES****10**

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can critically analyse the performance of pumps and turbines.

**TEXT BOOK:**

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2004.

**REFERENCES:**

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2004
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011

**AT6301****AUTOMOTIVE ENGINES****L T P C  
3 0 0 3****OBJECTIVES:**

- 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**

**OUTCOMES:**

- The main objective of this course is to impart knowledge in automotive engine. The detailed concept, construction and principle of operation of engine and various engine components, combustion, cooling and lubrication systems will be taught to the students. At the end of the course the students will have command over automotive engines and the recent development in the area of engines.

**TEXT BOOKS:**

1. Ganesan V., "Internal Combustion Engines", Tata McGraw Hill, 2007
2. Ramalingam K.K., "Internal Combustion Engines", Sci-Tech Publications, 2005.
3. Devaradjane. Dr. G., Dr. M. Kumaresan, "Automobile Engineering", AMK Publishers, 2013.

**REFERENCES:**

1. Heisler, "Advanced Engine Technology" SAE Publication, 1995
2. Edward F. Obert "Internal Combustion Engines" 3 Edition, 1970
3. Gupta. H.N. "Fundamentals of Internal Combustion" Engines, reprint, PHI Learning Pvt. Ltd. 2006
4. Mathur and Sharma "Fundamental Combustion Engines" Dhanpat Rai and Sons, 2002
5. John B. Heywood, "Fundamentals of Internal Combustion Engines", 1988

**AT6302**

**MECHANICS OF MACHINES**

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

**OBJECTIVES:**

- To understand the principles in the formation of mechanisms and their kinematics.
- To understand the effect of friction in different machine elements.
- To analyse the forces and toques acting on simple mechanical systems
- To understand the importance of balancing and vibration.

**UNIT I KINEMATIC OF MECHANICS 10**

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons – Analytical methods



**OBJECTIVES:**

- 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 tools, 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****OUTCOMES:**

- The Students can able to use different manufacturing process and use this in industry for component production

**TEXT BOOKS:**

- Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
- 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. Jain. R.K., and S.C. Gupta, "Production Technology", 16th Edition, Khanna Publishers, 2001.
3. "H.M.T. "Production Technology – Handbook", Tata McGraw-Hill, 2000.
4. Roy. A. Linberg, "Process and Materials of Manufacture", PHI, 2000.
5. Adithan. M., and A.B. Gupta, "Manufacturing Technology", New Age, 2006.

**AT6311****AUTOMOTIVE COMPONENTS LABORATORY****L T P C  
0 0 3 2****OBJECTIVES:**

- To train the Students to know the details of different components, dismantley and assembling them.

**LIST OF EXPERIMENTS**

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
8. Vehicle Frame
9. Study, dismantling and assembling of front and rear
10. Axles
11. Study, dismantling and assembling of differential
12. Study, dismantling and assembling of Clutch
13. Study, dismantling and assembling of Gear Box
14. Study of steering system

**TOTAL: 45 PERIODS****OUTCOMES**

- Ability to dismantle and assemble the automobile components

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>S. No.</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty.</b>
1	Multi Cylinder Petrol Engine	2 No.
2	Multi Cylinder Diesel Engine	2 No.
3	Petrol and Diesel fuel systems	2 No. 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.

**OBJECTIVES:**

- Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

**LIST OF EXPERIMENTS**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to use the measurement equipments for flow measurement
- Ability to do performance trust on different fluid machinery

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S. No.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

**TOTAL: 45 PERIODS****OBJECTIVES:**

- Demonstration and study of the various machines. The Main emphasis will be on a complete understanding of the machine capabilities and processes.

## LIST OF EXPERIMENTS

### UNIT I LATHE PRACTICE

- Plain Turning
- Taper Turning
- Thread Cutting

Estimation of machining time for the above turning processes.

### UNIT II DRILLING PRACTICE

- Drilling
- Tapping
- Reaming.

### UNIT III MILLING

- Surface Milling.
- Gear Cutting.
- Contour Milling.

### UNIT IV PLANNING AND SHAPING

- Cutting Key Ways.
- Dove tail machining.

**TOTAL: 45 PERIODS**

#### OUTCOMES:

- Ability to use different machine tools to manufacturing gears.
- Ability to use different machine tools for finishing operations
- Ability to manufacture tools using cutter grinder
- Develop CNC part programming

#### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	NAME OF THE EQUIPMENT	Qty.
1	Lathe	15 Nos.
2	Drilling Machine	1 No.
3	Milling Machine	2 Nos.
4	Planning Machine	1 No
5	Shaping Machine	2 Nos.

**MA6452**

**STATISTICS AND NUMERICAL METHODS**

**L T P C**

**3 1 0 4**

#### OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

### UNIT I TESTING OF HYPOTHESIS

**9+3**

Large sample test based on Normal distribution for single mean and difference of means - Tests based on  $t$ ,  $t^2$  and F distributions for testing means and variances – Contingency table (Test for Independency) – Goodness of fit.

**UNIT II DESIGN OF EXPERIMENTS****9+3**

One way and two way classifications - 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 – Eigen values of a matrix by power method.

**UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION****9+3**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations 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 order equations – Milne's predictor corrector methods for solving first order equations – Finite difference methods for solving second order equations.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- It helps the students to have a clear perception of the power of statistical and numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

**TEXT BOOKS:**

1. Johnson. R.A., and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", 11<sup>th</sup> Edition, Pearson Education, Asia, 2011.
2. Grewal. B.S., and Grewal. J.S., "Numerical Methods in Engineering and Science", 9<sup>th</sup> Edition, Khanna Publishers, New Delhi, 2007.

**REFERENCES:**

1. Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8<sup>th</sup> Edition, Pearson Education, Asia, 2007.
2. Spiegel. M.R., Schiller. J., and Srinivasan. R.A., "Schaum's Outlines on 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" Pearson Education, Asia, New Delhi, 2006.

**AT6401 APPLIED THERMODYNAMICS AND HEAT TRANSFER****L T P C  
3 1 0 4****OBJECTIVES:**

- To familiarize the students to understand the applied thermodynamics and heat transfer.

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)



**UNIT I            GAS POWER CYCLES****10**

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

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

Single acting and double acting air compressors, work required, effect of clearance volume, volumetric efficiency, isothermal efficiency, free air delivery, 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**

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian – 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**

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 – Flow over Bank of tubes – Free Convection – Dimensional Analysis – Flow over Vertical Plate.

**UNIT V            RADIATION****5**

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 (L:45+T:15): 60 PERIODS****OUTCOMES:**

- It helps the students to have a clear idea of application of thermodynamics and heat transfer. The student would be able to identify the applications of these techniques in their engineering fields.

**TEXT BOOKS:**

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

**REFERENCES:**

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

**OBJECTIVES:**

- 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.

**UNIT I ALLOYS AND PHASE DIAGRAMS 9**

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

**UNIT II HEAT TREATMENT 10**

Definition – Full annealing, stress relief, recrystallisation and spheroidising – 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, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening. .

**UNIT III FERROUS AND NON-FERROUS METALS 9**

Effect of alloying additions on steel- and stabilisers– stainless and tool steels – HSLA, Maraging steels – Cast Iron - Grey, white, malleable, spheroidal – alloy cast irons, Copper and copper alloys – Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

**UNIT IV NON-METALLIC MATERIALS 9**

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics – Properties and applications of  $Al_2O_3$ , SiC,  $Si_3N_4$ , PSZ and SIALON –Composites-Classifications- Metal Matrix and FRP - Applications of Composites.

**UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 8**

Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Impact test Izod and Charpy, fatigue and creep failure mechanisms.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to use different materials, their processing, heat treatments in suitable application in mechanical engineering fields.

**TEXT BOOKS:**

- Avner, S.H., "Introduction to Physical Metallurgy", McGraw Hill Book Company, 1994.
- Williams D Callister, "Material Science and Engineering", Revised Indian edition, Wiley India Pvt Ltd, 2007

**REFERENCES:**

- Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt. Ltd., 1999.
- Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", 4<sup>th</sup> Indian Reprint, Prentice Hall of India Private Limited, 2002.
- Upadhyay. G.S. and Anish Upadhyay, "Materials Science and Engineering", Viva Books Pvt.Ltd., New Delhi, 2006.
- U.C.Jindal : Material Science and Metallurgy, "Engineering Materials and Metallurgy", First Edition, Dorling Kindersley, 2012

**OBJECTIVES:**

To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9**

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains – Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

**UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9**

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending – bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

**UNIT III TORSION 9**

Torsion formulation stresses and deformation in circular and hollow shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

**UNIT IV DEFLECTION OF BEAMS 9**

Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.

**UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9**

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lamé's theorem.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
- Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

**TEXT BOOKS:**

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

**REFERENCES:**

1. Egor. P. Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2001
2. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2007.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2007
4. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.

**OBJECTIVES:**

- 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****OUTCOMES:**

- The students will be well versed in the fundamental knowledge of electronic and its applications.

**TEXT BOOKS**

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

**REFERENCES**

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

**OBJECTIVES:**

- 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 LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM 9**

Basic construction of chassis, Types of Chassis layout, with reference to Power Plant location and drive, various, types of frames, Loads acting on vehicle frame, Types of Front Axles and Stub Axles, Front Wheel Geometry. Condition for True Rolling Motion. Ackerman's and Davi's Steering Mechanisms, Steering Linkages, Different Types of Steering Gear boxes, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power Steering.

**UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL 9**

Driving Thrust and its effects, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Final drive, different types of final drive, Worm and Worm wheel, straight bevel gear, spiral bevel gear and hypoid gear final drive. Differential principle. Constructional details of differential unit, Differential housings, Non–Slip differential, Differential locks.

**UNIT III REAR AXLES, WHEELS, RIMS AND TYRES 9**

Construction of rear axles, Types of Loads acting on rear axles, Full –Floating, Three–Quarter Floating and Semi–Floating Axles, Twist beam rear axle, Types, Multi axles vehicles. Wheels and Rims, Types of Tyres and their constructional details.

**UNIT IV SUSPENSION SYSTEM 9**

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

**UNIT V BRAKE SYSTEMS 9**

Need for Brake systems, Stopping Distance, Time and Braking Efficiency, Effect of Weight Transfer during Braking, Classification of brakes , Braking Torque, drum brake and disc Brake Theory, Types and Construction of Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Servo Brakes, Retarders – antilock braking systems(ABS).

**TOTAL : 45 PERIODS****OUTCOMES**

- The students will understand the constructional, working principle of various sub system of an automobile.

**TEXT BOOKS**

1. Newton Steeds and Garret, "Motor Vehicles" 13<sup>th</sup> Edition, Butterworth, London, 2005.
2. Heinz Hazler, "Modern Vehicle Technology", Butterworth, London, 2005.
3. Devaradjane. Dr. G., Dr. M. Kumaresan, "Automobile Engineering", AMK Publishers, 2013.

**REFERENCES**

1. Heldt P.M., "Automotive Chassis" Chilton Co., New York, 1990
2. Giri. N.K., "Automotive Mechanics" Khanna Publishers, New Delhi, 2005.
3. Milliken & Milliken, "Race Car Vehicle Dynamics", SAE, 1995

PR6412

**COMPUTER AIDED MACHINE DRAWING LABORATORY**

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

**OBJECTIVES:**

- To introduce the students the Indian standard code of practice for engineering drawing and general symbols and abbreviation used on the drawing.
- To provide hands on experience to develop 2D and 3D models of engineering components.

**LIST OF EXPERIMENTS**

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**

**OUTCOMES**

- Ability to develop engineering drawing for the industrial component using Indian Standard code of practice.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S. No.	NAME OF THE EQUIPMENT	Qty.
1	Computer nodes	30 Nos.
2	<b>Software</b>	
	Drafting Software	15 licenses
	Modeling Software -	5 Nos.

EC6466

**ELECTRONICS AND MICROPROCESSORS LABORATORY**

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

**OBJECTIVES:**

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

**LIST OF EXPERIMENTS**

**ELECTRONICS**

**30**

1. VI Characteristics of PN Junction Diode
2. VI Characteristics of Zener Diode
3. Characteristics of CE Transistor
4. Characteristics of JFET
5. Characteristics of Uni Junction Transistor
6. RC or Wein Bridge Oscillator
7. Study of Logic Gates (Basic Gates)
8. Half Adder and Full Adder
9. Shift Registers and Counters
10. Operational Amplifier (Adder, Subtractor, Differentiator, Integrator, Inverting and Non – Inverting)

## MICROPROCESSORS

15

1. Block Transfer
2. 8 bit Addition, Subtraction
3. Multiplication and Division
4. Maximum and Minimum of block of data
5. Sorting
6. Stepper Motor Interfacing

**TOTAL : 45 PERIODS**

### OUTCOMES:

- Ability to perform speed characteristic of different electronics and microprocessor machine

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	NAME OF THE EQUIPMENT	Qty.
1	Voltmeters	5 Nos.
2	Ammeters	5 Nos.
3	PN Diode, BJT, JFET, Logic Gates, Shift Registers and Counters	1 set.
4	Digital Logic Trainer Kits	1 No
5	Breadboards	1 No
6	Microprocessor Kits – 8085	5 Nos.
7	D/A Converter Interface	1 No
8	Stepper Motor Interface	1 No.
9	CRO	1 No.
10	Wavefarm Generator	1 No.
11	Multimeter	1 No.

**CE6315**

**STRENGTH OF MATERIALS LABORATORY**

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

### OBJECTIVES

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
- (i) Hardened samples and
  - (ii) Hardened and tempered samples.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to perform different destructive testing
- Ability to characteristic materials

**LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	3
8	Muffle Furnace (800 C)	1

**GE6351**

**ENVIRONMENTAL SCIENCE AND ENGINEERING**

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

**OBJECTIVES:**

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY**

**12**

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – 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 10**

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO<sub>2</sub>, NO<sub>x</sub>, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies –  
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 overutilization of surface and ground 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. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; 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. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants.  
Field study of local area to document environmental assets – river / forest / grassland / hill /mountain.

## **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

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 – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides.  
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 –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

**TEXT BOOKS :**

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2<sup>nd</sup> edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

**REFERENCES :**

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

**ME6503****DESIGN OF MACHINE ELEMENTS****L T P C  
3 0 0 3****OBJECTIVES:**

- To familiarize 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  
(Use of P S G Design Data Book is permitted)

**UNIT I            STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS            10**

Introduction to the design process - factors 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 – curved beams – crane hook and 'C' frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

**UNIT II            SHAFTS AND COUPLINGS            8**

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines – crankshafts - Rigid and flexible couplings.

**UNIT III            TEMPORARY AND PERMANENT JOINTS            9**

Threaded fastners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

**UNIT IV ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9**

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

**UNIT V BEARINGS 9**

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to apply the successfully design various mechanical components

**TEXT BOOKS:**

1. Bhandari V, "Design of Machine Elements", 3<sup>rd</sup> Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8<sup>th</sup> Edition, Tata McGraw-Hill , 2008.

**REFERENCES:**

1. Sundararajamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design" ,4<sup>th</sup> Edition, Wiley, 2005
3. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill Book Co. (Schaum's Outline), 2010
4. Bernard Hamrock, Steven Schmid, Bo Jacobson, "Fundamentals of Machine Elements", 2<sup>nd</sup> Edition, Tata McGraw-Hill Book Co., 2006.
5. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
6. Ansel Ugural, "Mechanical Design – An Integral Approach, 1<sup>st</sup> Edition, Tata McGraw-Hill Book Co, 2003.
7. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8<sup>th</sup> Edition, Printice Hall, 2003.

**AT6501**

**AUTOMOTIVE TRANSMISSION**

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

**OBJECTIVES:**

- To know about the various transmission and drine line units of automobiles.

**UNIT I CLUTCH AND GEAR BOX 9**

Requirement of transmission system, Different types of clutches, principle & Construction of Single plate coil spring and Diaphragm spring clutches., Need and Objectives of Gear box. Construction and operation of Sliding mesh, Constant mesh and Synchromesh gearboxes. – Determination of gear ratios for vehicles. Performance characteristics in different speeds. Problems on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & Power and acceleration.

**UNIT II HYDRODYNAMIC TRANSMISSION 9**

Fluid coupling-Principle-Constructional details. Torque capacity. Performance characteristics. Reduction of drag torque in fluid coupling. Torque converter-Principle-constructional details, performance characteristics. Multistage torque converters and Polyphase torque converters.

**UNIT III EPICYCLIC GEARBOXES USED IN AUTOMATIC TRANSMISSION 9**  
Principle of Planetary gear trains - Wilson Gear box, Cotal electromagnetic transmission- Hydraulic control system for Automatic Transmission.

**UNIT IV AUTOMATIC TRANSMISSION APPLICATIONS 9**  
Need for automatic transmission, Four speed longitudinally mounted automatic transmission - Chevrolet "Turboglide" Transmission, Continuously Variable Transmission (CVT) – Types – Operations of a typical CVT.

**UNIT V HYDROSTATIC AND ELECTRIC DRIVE 9**  
Hydrostatic drive; Various types of hydrostatic systems – Principles of Hydrostatic drive system. Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical Janny hydrostatic drive. Electric drive-types- Principle of early and modified Ward Leonard Control system-Advantages & limitations.

**TOTAL : 45 PERIODS**

### OUTCOMES

- The students will understand the constructional, working principle of various types of manual and automotive transmission of an automobile.

### TEXT BOOKS:

1. Heldt, P.M., "Torque converters", Chilton Book Co., 1962.
2. Newton and Steeds, "Motor vehicles", Illiffe Publishers, 1985.
3. Devaradjane. Dr. G., Kumaresan. Dr. M., "Automobile Engineering", AMK Publishers, 2013.

### REFERENCES:

1. SAE Transactions 900550 & 930910.
2. Hydrostatic transmissions for vehicle applications, I Mech E Conference, 1981-88.
3. Crouse,W.H., Anglin,D.L.," Automotive Transmission and Power Trains construction", McGraw Hill, 1976.
4. Heinz Heisler, "Advance vehicle Technology", Butterworth-Heinemann, 2002

**AT6502 AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS L T P C**  
**3 0 0 3**

### OBJECTIVES

- Knowledge in vehicle electrical and electronics components for engine operation.
- Enhancing the knowledge of revsor and microprocessor applications in vehicle control systems.
- Gaining information's on modern safety system in vehicle braking.

**UNIT I BATTERIES AND STARTING SYSTEM 10**  
Different types of Batteries – principle, rating, testing and charging. Starter motors characteristics, capacity requirements. Drive mechanisms. Starter switches.

**UNIT II CHARGING SYSTEM LIGHTING AND ACCESSORIES 9**  
DC Generators and Alternators their characteristics. Control unit – cut out, electronic regulators. Vehicle interior lighting system. Vehicle exterior lighting system. Wiring requirements. Lighting design. Dashboard instruments. Horn, trafficator.

**UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEM 9**

Spark plugs. Advance mechanisms. Different types of ignition systems. Electronic fuel injection systems, mono and multi point fuel injection system (MPFI).

**UNIT IV SENSORS AND MICROPROCESSORS IN AUTOMOBILES 9**

Basic sensor arrangements. Types of sensors – oxygen sensor, hot wire anaemometer sensor, vehicle speed sensor, detonation sensor, accelerometer sensor, crank position sensor. Microprocessor and microcomputer controlled devices in automobiles such voice warning system, travel information system, keyless entry system, automatic transmission system, electronic steering system.

**UNIT V SAFETY SYSTEMS 8**

Antilock braking system, air bag restraint system, voice warning system, seat belt system, road navigation system, anti theft system.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- The student will have to know about all theoretical information and about electrical components used in a vehicle.

**TEXTBOOK:**

1. Judge. A.W., "Modern Electrical Equipment of Automobiles", Chapman & Hall, London, 1992

**REFERENCES:**

1. Young.A.P., & Griffiths.L., "Automobile Electrical Equipment", English Language Book Society & New Press, 1990
2. Spreadbury. F.G., "Electrical Ignition Equipment", Constable & Co Ltd., London, 1962
3. Robert N Brady "Automotive computers and Digital Instrumentation". A Reston Book, Prentice Hill, Eagle Wood Cliffs, New Jersey, 1988.

**AT6503 VEHICLE DESIGN AND DATA CHARACTERISTICS L T P C  
3 0 0 3**

**OBJECTIVES:**

- 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 9**

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 9**

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 – I 9**

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 PERFORMANCE CURVES – II 9**

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 9**

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

**TOTAL: 60 PERIODS**

**OUTCOMES**

- The students can able to understand the basic design principle of vehicle, able to draw the performance curves pertain to engine and chassis.

**TEXT BOOKS**

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

**REFERENCE:**

1. Gupta. R.B., "Automobile Engineering", Sathya Prakashan, 8 edu., 2013.

**AT6504 AUTOMOTIVE FUELS AND LUBRICANTS L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the properties of fuels and lubricants for the design and operation of the I.C engines.

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

Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

**UNIT II THEORY OF LUBRICATION 9**

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

**UNIT III 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, test used in grease.

**UNIT IV PROPERTIES AND TESTING OF FUELS****9**

Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, flash point, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion etc.

**UNIT V COMBUSTION & FUEL RATING****9**

SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements. CI Engine, mechanism of combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives – specifications of fuels.

**TOTAL : 45 PERIODS****OUTCOMES:**

- At the end of the course, the student can understand the importance, manufacturing methods, testing methods, combustion methodology of automotive fuels and lubricants.

**TEXT BOOKS:**

1. Ganesan.V., "Internal Combustion Engineering", Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. Mathur. M.L., Sharma. R.P. "A course in internal combustion engines", Dhanpatrai publication, 2003.
3. Obert.E.F "Internal Combustion Engineering and Air Pollution", International book Co., 1988.

**REFERENCES:**

1. Brame, J.S.S. and King, J.G. – "Fuels Solids, Liquids, Gaseous". Edward Arnold, 1961
2. Francis, W, "Fuels and Fuel Technology", Vol. I & II, Pergamon, 1965
3. Hobson, G.D. & Pohl.W "Modern Petroleum Technology", 1974
4. Lansdown. A.R., Lubrication, "A practical guide to lubricant selection", Pergamon press, 1982.
5. Raymond. C. Gunther, "Lubrication", Chilton Book Co., 1971.

**GE6563****COMMUNICATION SKILLS – LABORATORY BASED****L T P C  
0 0 4 2****OBJECTIVES:**

- To provide opportunities to learners to practice their communicative skills to make them become proficient users of English.
- To enable learners to fine-tune their linguistic skills (LSRW) with the help of technology to communicate globally.
- To enhance the performance of learners at placement interviews and group discussions and other recruitment procedures.

**UNIT I LISTENING / VIEWING****10**

Listening and note-taking – Listening to telephonic conversations – Ted talks – Inspiring Speeches – Watching documentaries on personalities, places, socio-cultural events, TV news programmes and discussions to answer different kinds questions, viz., identifying key idea and comprehension questions... so on.

**UNIT II SPEAKING 12**  
 Conversation practice – Interview – Group Discussion – Introducing oneself and others – Role play – Debate – Presentation – Panel discussion – Neutral accent.

**UNIT III READING 10**  
 Different genres of text (literature, media, technical) for comprehension – Reading strategies like note-making – reading graphs, charts and graphic organizer – Sequencing sentences – reading online sources like e-books, e-journals and e-newspapers.

**UNIT IV WRITING 12**  
 Blogs – Tweets – Online resume/ – e-mails – SMS and Online texting – Report writing – Describing charts and tables – Writing for media on current events.

**UNIT V VOCABULARY 8**  
 Idioms and Phrases – Proverbs – Collocations – Chunks of language.

**UNIT VI GRAMMAR 8**  
 Sentence structures – Subject-Verb agreement – Pronoun-Antecedent agreement – Tense forms – Active and passive voices – Direct and Indirect speeches – Cohesive devices.

**TOTAL: 60 PERIODS**

**TEACHING METHODS:**

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for gaining proficiency and better participation in the class.

**Lab Infrastructure:**

S. No.	Description of Equipment (minimum configuration)	Qty Required
1	<b>Server</b>	1 No.
	• PIV System	
	• 1 GB RAM / 40 GB HDD	
	• OS: Win 2000 server	
	• Audio card with headphones	
	• JRE 1.3	
2	<b>Client Systems</b>	60 Nos.
	• PIII System	
	• 256 or 512 MB RAM / 40 GB HDD	
	• OS: Win 2000	
	• Audio card with headphones	
	• JRE 1.3	
3	Handicam	1 No.
4	Television 46"	1 No.
5	Collar mike	1 No.
6	Cordless mike	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	1 No.
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### Evaluation:

#### Internal: 20 marks

Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

#### External: 80 marks

Online Test	- 35 marks
Interview	- 15 marks
Presentation	- 15 marks
Group Discussion	- 15 marks

#### Note on Internal and External Evaluation:

1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking – example for role play:
  - a. Marketing engineer convincing a customer to buy his product.
  - b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation – should be extempore on simple topics
4. Discussion – topics of different kinds; general topics, case studies and abstract concept

### OUTCOMES:

#### At the end of the course, learners should be able to

- Take international examination such as IELTS and TOEFL
- Make presentations and Participate in Group Discussions.
- Successfully answer questions in interviews.

### REFERENCES:

1. Barker, A. **Improve Your Communication Skills**. New Delhi: Kogan Page India Pvt. Ltd., 2006.
2. Craven, Miles. **Listening Extra – A resource book of multi-level skills activities**. Cambridge University Press, 2004.
3. Gammidge, Mick. **Speaking Extra - A resource book of multi-level skills activities**. Cambridge University Press, 2004.
4. Hartley, Peter. **Group Communication**. London: Routledge, 2004.
5. John Seely. **The Oxford Guide to Writing and Speaking**. New Delhi: Oxford University Press, 2004.
6. Naterop, Jean & Rod Revell. **Telephoning in English**. Cambridge University Press, 1987.
7. Ramesh, Gopalswamy and Mahadevan Ramesh. **The ACE of Soft Skills**. New Delhi: Pearson, 2010.

### Web Sources:

[www.humanresources.about.com](http://www.humanresources.about.com)  
[www.careerride.com](http://www.careerride.com)

**OBJECTIVES:**

- To introduce the testing procedure for electrical and electronics system in automobile.

**LIST OF EXPERIMENTS****a. Electrical Laboratory**

- Testing of batteries and battery maintenance
- Testing of starting motors and generators
- Testing of regulators and cut – outs
- Diagnosis of ignition system faults
- Study of Automobile electrical wiring

**b. Electronics Laboratory**

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

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to rectify and faults in electrical and electronics systems and maintain the same.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Battery, hydrometer, voltage tester	1 No. each
2	Starter motor, regulator, cut-out	1 No. each
3	Distributor, ignition coil, spark plug	1 No. each
4	Auto electrical wiring system	1 No.
5	Rectifiers, filters	15 Nos. each
6	Bread board, Logic gates ICs,	15 Nos. each
7	Amplifier	15 Nos
8	IC timer	15 Nos
9	Data logger	1 No.
10	8085 trainer kit	10 Nos
11	ADC interface board	2 Nos
12	DAC interface board	2 Nos
13	Sensors like RTD, Load cell, LVDT	2 Nos
14	Actuators like stepper motor	2 Nos

**OBJECTIVES:**

- To study the characteristics of the fuels and Lubricants used in automobile

**LIST OF EXPERIMENTS**

- Study of International and National standards for fuels and lubricants.
- Study of Octane and Cetane Number of fuels.
- ASTM distillation test of liquid fuels
- Aniline Point test of diesel
- Calorific value of liquid fuel.
- Calorific value of gaseous fuel.
- Reid vapour pressure test.
- Flash and Fire points of petrol and diesel.
- Copper strip Corrosion Test
- Cloud & Pour point Test.
- Temperature dependence of viscosity of lubricants & Fuels by Redwood Viscometer.
- Viscosity Index of lubricants & Fuels by Saybolt Viscometer
- Ash content and Carbon Residue Test
- Drop point of grease and mechanical penetration in grease.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to characteristic and chase the fuels and Lubricantes for the automobiles.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Flash and fire point apparatus (for petrol)	1 No.
2	Aniline point Apparatus	1 No
3	Reid vapor pressure test Apparatus	1 No.
4	Bomb and Gas Calorimeters	1 No.each
5	Carbon Residue Test Apparatus	1 No.
6	Copper Strip Corrosion Test Apparatus	1 No.
7	Cloud and Pour point Apparatus	1 No.
8	Redwood Viscometer	1 No.
9	Saybolt Viscometer	1 No.
10	ASTM distillation test Apparatus	1 No.
11	Ash content Test Apparatus	1 No.
12	Drop point and penetration Apparatus for grease	1 No.

**OBJECTIVES:**

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

**UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS****9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and

contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

**UNIT II PLANNING 9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

**UNIT III ORGANISING 9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

**UNIT IV DIRECTING 9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

**UNIT V CONTROLLING 9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS**

**OUTCOME :**

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

**TEXT BOOKS:**

1. Stephen P. Robbins & Mary Coulter, “Management”, 10<sup>th</sup> Edition, Prentice Hall (India) Pvt. Ltd., 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6<sup>th</sup> Edition, Pearson Education, 2004.

**REFERENCES:**

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management”, 7<sup>th</sup> Edition, Pearson Education, 2011.
2. Robert Kreitner & Mamata Mohapatra, “Management”, Biztantra, 2008.
3. Harold Koontz & Heinz Wehrich “Essentials of management” Tata McGraw Hill, 1998.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata Mcgraw Hill, 1999

**OBJECTIVES:**

- 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****9**

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 pushrods.

**UNIT II DESIGN OF CYLINDER, PISTON AND CONNECTING ROD****9**

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****9**

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****9**

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****9**

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: 45 PERIODS**

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

**OUTCOMES:**

- Upon completion of the course, students will be able to impart knowledge in automotive engine. The detailed concept, construction and principle of operation of engine and various engine components, combustion, cooling and lubrication systems will be taught to the students. At the end of the course the students will have command over automotive engines and the recent development in the area of engines.

**TEXT BOOK:**

- Khurmi. R.S. & Gupta. J.K., "A text book of Machine Design", Eurasia Publishing House (Pvt) Ltd, 2001.

**REFERENCES:**

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

**OBJECTIVES:**

- 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 9**

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 9**

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 9**

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 9**

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 9**

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: 45 PERIODS****OUTCOMES**

- At the end of the course, the student can able to design the automotive components like frame, suspension systems, axles, clutch, gear box, drive line components etc

**TEXT BOOKS:**

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

**REFERENCES:**

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

**OBJECTIVES:**

- 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 THE POWER UNIT****9**

Two stroke and four stroke SI & CI engine Construction and Working, merits and demerits, Symmetrical and unsymmetrical valve & port timing diagrams. Scavenging process.

**UNIT II FUEL AND IGNITION SYSTEMS****9**

Fuel system – Different circuits in two wheeler fuel systems, fuel injection system. Lubrication system, Ignition systems - Magneto coil and battery coil spark ignition system, Electronic ignition System, Starting system - Kick starter system – Self starter system. Recent technologies.

**UNIT III CHASSIS AND SUB-SYSTEMS****9**

Main frame for two and three wheelers, its types, Chassis and different drive systems for two wheelers, Single, multiple plates and centrifugal clutches, Gear box and its and various gear controls in two wheelers. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar, Freewheeling devices

**UNIT IV BRAKES AND WHEELS****8**

Drum brakes & Disc brakes Construction and Working and its Types, Front and Rear brake links layouts. Brake actuation mechanism. Spoked wheel, cast wheel, Disc wheel & its merits and demerits. Tyres and tubes Construction & its Types. Steering geometry.

**UNIT V TWO & THREE WHEELERS – CASE STUDY****10**

Case study of Sports bike, Motor cycles, Scooters and Mopeds - Auto rickshaws, Pick up van, Delivery van and Trailer. Servicing and maintenance. Recent developments.

**TOTAL : 45 PERIODS****OUTCOMES:**

- The students can able to understand the various subsystem of two and three wheeler and also know how it is different from light motors and heavy motor vehicles.

**TEXT BOOKS:**

- Irving,P.E.," Motor cycle Engineering", Temple Press Book, London, 1992.

**REFERENCES:**

- The Cycle Motor Manual, Temple Press Ltd., London, 1990.
- Ramalingam. K. K., "Two Wheelers", Scitech publications, Chennai,2009
- Marshall Cavendish, Encyclopedia of Motor cycling, 20 volumes, New York and London, 1989.
- Bryaut, R.V., Vespa "Maintenance and Repair series".
- Raymond Broad Lambretta – "A practical guide to maintenance and repair", 1987.

**OBJECTIVES**

- To know about the application of basic mechanics principles for dynamic analysis of vehicles.

**UNIT I CONCEPT OF VIBRATION****9**

Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Free, Forced, Undamped and Damped Vibration, Response Analysis of Single DOF, Two DOF, Multi DOF, Magnification factor, Transmissibility, Vibration absorber, Vibration measuring instruments, Torsional vibration, Critical speed.

**UNIT II TIRES****9**

Tire forces and moments, Tire structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tires. Magic formulae tire model, Estimation of tire road friction. Test on Various road surfaces. Tire vibration.

**UNIT III VERTICAL DYNAMICS****9**

Human response to vibration, Sources of Vibration. Design and analysis of Passive, Semi-active and Active suspension using Quarter car, half car and full car model. Influence of suspension stiffness, suspension damping, and tire stiffness. Control law for LQR, H-Infinite, Skyhook damping. Air suspension system and their properties.

**UNIT IV LONGITUDINAL DYNAMICS AND CONTROL****9**

Aerodynamic forces and moments. Equation of motion. Tire forces, rolling resistance, Load distribution for three wheeler and four wheeler. Calculation of Maximum acceleration, Reaction forces for Different drives. Braking and Driving torque. Prediction of Vehicle performance. ABS, stability control, Traction control.

**UNIT V LATERAL DYNAMICS****9**

Steady state handling characteristics. Steady state response to steering input. Testing of handling characteristics. Transient response characteristics, Direction control of vehicles. Roll center, Roll axis, Vehicle under side forces. Stability of vehicle on banked road, during turn. Effect of suspension on cornering.

**TOTAL : 45 PERIODS****OUTCOMES**

- The student will understand how passenger comfort is achieved along with vehicle stability.

**TEXT BOOKS:**

- Singiresu S. Rao, "Mechanical Vibrations", 5<sup>th</sup> Edition, Prentice Hall, 2010
- Wong. J. Y., "Theory of Ground Vehicles", 3<sup>rd</sup> Edition, Wiley-Interscience, 2001
- Rajesh Rajamani, "Vehicle Dynamics and Control", 1<sup>st</sup> edition, Springer, 2005
- Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics", Society of Automotive Engineers Inc, 1992

**REFERENCES:**

- Dean Karnopp, "Vehicle Stability", 1<sup>st</sup> edition, Marcel Dekker, 2004
- Nakhaie Jazar. G., "Vehicle Dynamics: Theory and Application", 1<sup>st</sup> edition, Springer, 2008
- Michael Blundell & Damian Harty, "The Multibody Systems Approach to Vehicle Dynamics", Elsevier Limited, 2004
- Hans B Pacejka, "Tire and Vehicle Dynamics", 2<sup>nd</sup> edition, SAE International, 2005



5. John C. Dixon," Tires, Suspension, and Handling", 2<sup>nd</sup> edition, Society of Automotive Engineers Inc, 1996
6. Jan Zuijdijk, 'Vehicle dynamics and damping", Author House, 2009

**AT6611          COMPUTER AIDED ENGINE AND CHASSIS DESIGN LABORATORY          L T P C**  
**0 0 3 2**

**OBJECTIVES:**

- To familiarise the students to use modeling software to model engine components and chassis design

**LIST OF ENGINE DESIGN 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.

**LIST OF CHASSIS DESIGN EXPERIMENTS**

**CLUTCH**

10. Complete design of clutch components.
11. Assembly drawing of clutch using drafting software.

**GEAR BOX**

12. Gear train calculations.
13. Layout of gear box.
14. Calculation of bearing loads
15. Selection of bearings.
16. Assembly drawing of gear box using drafting software.

**DRIVE LINE AND REAR AXLE**

17. Design of propeller shaft.
18. Design details of final drive gearing.
19. Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings
20. Design aspects of final drive.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to use the drafty and modeling software for automobile components design

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	NAME OF THE EQUIPMENT	Qty.
1	Computer nodes	15 Nos.
2	Drafting and Modeling Softwares	15 licenses each

AT6612

TWO AND THREE WHEELERS LABORATORY

L T P C  
0 0 3 2

**OBJECTIVES:**

- To train the students to conduct performance test on two and three wheelers
- To train the students to dismatle and assemble the gear box, steering system etc.,

**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**

**OUTCOMES:**

- Ability to assemble the engine components and conduct performance test on two and three wheelers.

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	NAME OF THE EQUIPMENT	Qty.
1	Two wheeler chassis dynamometer	1 No.
2	Coil spring test rig	1 No.
3	Chain tension test rig	1 No.
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.

**OBJECTIVES:**

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

**UNIT I FUNDAMENTALS OF 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****OUTCOMES:**

- At the end of the course, the student will understand the role of various sensor, its construction and working principle and its influence in controlling pollution, enhancing safety of the vehicle.

**TEXT BOOKS:**

- William B Ribbens "Understanding Automotive Electronics", SAE Publications, 1998
- Eric Chowanietz "Automobile Electronics" SAE Publications, 1994

**REFERENCES:**

- Robert Bosch "Diesel Engine Management" SAE Publications, 2006.
- Robert Bosch, "Gasoline Engine Management" SAE Publications, 2006.

**OBJECTIVES:**

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

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

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

**UNIT II ONE-DIMENSIONAL PROBLEMS****9**

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation – Transverse deflections and Natural frequencies of beams.

**UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS****9**

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation – Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts – Quadrilateral elements – Higher Order Elements.

**UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS****9**

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

**UNIT V ISOPARAMETRIC FORMULATION****9**

Natural co-ordinate systems – Isoparametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the Students can able to understand different mathematical Techniques used in FEM analysis and use of them in Structural and thermal problem

**TEXT BOOKS:**

1. Reddy. J.N., “An Introduction to the Finite Element Method”, 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2005
2. Seshu, P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

**REFERENCES:**

1. Rao, S.S., “The Finite Element Method in Engineering”, 3<sup>rd</sup> Edition, Butterworth Heinemann, 2004.
2. Logan, D.L., “A first course in Finite Element Method”, Thomson Asia Pvt. Ltd., 2002.
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4<sup>th</sup> Edition, Wiley Student Edition, 2002.
4. Chandrupatla & Belagundu, “Introduction to Finite Elements in Engineering”, 3<sup>rd</sup> Edition, Prentice Hall College Div, 1990.
5. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley & Sons, 2013

**OBJECTIVES:**

- To know about the various methods of maintaining vehicles and their subsystems.

**UNIT I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS 10**

Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures – workshop operations – workshop manual - vehicle identification. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.

**UNIT II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE 8**

General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls

**UNIT III TRANSMISSION AND DRIVELINE MAINTENANCE 8**

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

**UNIT IV STEERING, BRAKE, SUSPENSION, WHEEL MAINTENANCE 11**

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, Parking brake. Bleeding of brakes. Inspection, Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, power steering system

**UNIT V AUTO ELECTRICAL AND AIR CONDITIONING MAINTENANCE 10**

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis  
Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

**TOTAL : 45 PERIODS****OUTCOMES**

- Upon the completion of the course, the student can able to understand the importance of maintenance and also the step by step procedure for maintain the various automotive sub systems

**TEXT BOOKS**

- Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
- Ed May, "Automotive Mechanics Volume Two" , Mc Graw Hill Publications, 2003
- Vehicle Service Manuals of reputed manufacturers

**REFERENCES**

- Bosch Automotive Handbook, Sixth Edition, 2004

**OBJECTIVES:**

- The main objective of this course is to impart knowledge in automotive pollution control. The detailed concept of formation and control techniques of pollutants like UBHC, CO, NO<sub>x</sub>, particulate matter and smoke for both SI and CI engine will be taught to the students. The instruments for measurement of pollutants and emission standards will also be introduced to the students. At the end of the course the students will have command over automotive pollution and control.

**UNIT I INTRODUCTION****6**

Pollutants – sources – formation – effects of pollution on environment - human – transient operational effects on pollution – Regulated – Unregulated emissions - Emission Standards.

**UNIT II EMISSIONS IN SI ENGINE****11**

Chemistry of SI engine combustion – HC and CO formation in SI engines – NO formation in SI engines – Smoke emissions from SI engines – Effect of operating variables on emission formation.

**UNIT III EMISSIONS IN CI ENGINE****10**

Basics of diesel combustion – Smoke emission and its types in diesel engines – NO<sub>x</sub> emission and its types from diesel engines – Particulate emission in diesel engines. Odor, sulfur and Aldehyde emissions from diesel engines – effect of operating variables on emission formation.

**UNIT IV CONTROL TECHNIQUES FOR REDUCTION OF EMISSION****9**

Design modifications – Optimization of operating factors – Fuel modification – Evaporative emission control - Exhaust gas recirculation – SCR – Fumigation – Secondary Air injection – PCV system – Particulate Trap – CCS – Exhaust treatment in SI engines – Thermal reactors – Catalytic converters – Catalysts – Use of unleaded petrol.

**UNIT V TEST PROCEDURE, INSTRUMENTATION & EMISSION MEASUREMENT****9**

Test procedures CVS1, CVS3 – Test cycles – IDC – ECE Test cycle – FTP Test cycle - NDIR analyzer – Flame ionization detectors – Chemiluminescent analyzer – Dilution tunnel - Gas chromatograph – Smoke meters – SHED test.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Upon the completion of the course, the student will understand the fundamentals of formation of automobile pollutions in SI and CI Engines, various control techniques, test procedures etc.

**TEXT BOOKS:**

- Springer and Patterson, "Engine Emission", Plenum Press, 1990.
- Pundir. B.P., " IC Engines Combustion and Emissions" Narosa Publishers, 2010

**REFERENCES:**

- Ramalingam. K.K., "Internal Combustion Engines", Scitech Publications, 2003.
- Ganesan,V., "Internal Combustion Engines", Tata McGraw Hill Co., 1994.
- SAE Transactions, "Vehicle Emission", 3 volumes, 1982.
- Obert,E.F., "Internal Combustion Engines", 1982.
- Taylor,C.F., "Internal Combustion Engines", MIT Press, 1972.
- Heywood,J.B., "Internal Combustion Engine Fundamentals", McGraw Hill Book Co., 1995.
- Automobiles and Pollution SAE Transaction, 1995.

**OBJECTIVES:**

- To conduct performance test and emission test on the IC engines.

**LIST OF EXPERIMENTS**

- Study of hydraulic, electrical and eddy current dynamometers
- Valve timing and port timing diagram
- Performance and emission test on two wheeler SI engine
- Performance and emission test on automotive multi-cylinder SI engine
- Performance and emission test on automotive multi-cylinder CI engine
- Retardation test on I.C. Engines.
- Heat balance test on automotive multi-cylinder SI engine
- Heat balance test on automotive multi-cylinder CI engine
- Morse test on multi-cylinder SI engine
- P- and P-V diagrams for IC engine with piezo-electric pick up, charge amplifier, angle encoder and PC

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to control the emission and use of different equipments to conduct performance test.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

Sl. No.	NAME OF THE EQUIPMENT	QUANTITY
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

**OBJECTIVES:**

- To train the structures in identifying the fault and rectification.

**STUDY EXPERIMENTS:**

- Tools and instruments required for maintenance
- Safety aspects with respect to man, machine and tools
- General procedures for servicing and maintenance schedule
- Wheel Alignment procedure

**LIST OF EXPERIMENTS:**

1. Minor and major tune up of gasoline and diesel engines
2. Calibration of Fuel pump
3. Engine fault diagnosis using scan tool
4. Fault diagnosis and service of transmission system
5. Fault diagnosis and service of driveline system
6. Fault diagnosis and service of braking system
7. Fault diagnosis and service of suspension system
8. Fault diagnosis and service of steering system
9. Fault diagnosis and service of Electrical system like battery, starting system, charging system, lighting system etc
10. Fault diagnosis and service of vehicle air conditioning system
11. 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 tire and tube.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to identify the faults and knowledge on maintenance

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>Sl. No.</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty.</b>
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	1 No.
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



**OBJECTIVES:**

- The main objective of this course is to impart knowledge in the construction of vehicle, aerodynamic, concept, paneling of passenger car body trim. At the end of the course the student will be well versed in the design and construction of external body of the vehicles.

**UNIT I CAR BODY DETAILS****10**

Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – Visibility-regulations, driver's visibility, improvement in visibility and tests for visibility. Driver seat design -Car body construction-Variou panels in car bodies. Safety aspect of car body.

**UNIT II BUS BODY DETAILS****9**

Types of bus body: based on capacity, distance traveled and based on construction.– Bus body lay out for various types, Types of metal sections used – Regulations – Constructional details: Conventional and integral. driver seat design- Safety aspect of bus body.

**UNIT III COMMERCIAL VEHICLE DETAILS****8**

Types of commercial vehicle bodies - Light commercial vehicle body. Construction details of commercial vehicle body - Flat platform body, Trailer, Tipper body and Tanker body – Dimensions of driver's seat in relation to controls – Drivers cab design - Regulations.

**UNIT IV VEHICLE AERODYNAMICS****9**

Objectives, Vehicle drag and types. Various types of forces and moments. Effects of forces and moments. Side wind effects on forces and moments. Various body optimization techniques for minimum drag. Wind tunnels – Principle of operation, Types. Wind tunnel testing such as: Flow visualization techniques, Airflow management test – measurement of various forces and moments by using wind tunnel.

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

Types of materials used in body construction-Steel sheet, timber, plastics, GRP, properties of materials. Body trim items-body mechanisms.Hand tools-power tools-panel repair-repairing sheet metal-repairing plastics-body fillers-passenger compartment service- corrosion: Anticorrosion methods, Modern painting process procedure-paint problems

**TOTAL : 45 PERIODS****OUTCOMES**

Upon completion of the course, students will

- Know about different aspects of car body and bus body, types, commercial vehicle.
- Role of various aerodynamic forces and moments, measuring instruments
- Know about the material used in body building, tools used, body repairs.

**TEXT BOOKS:**

- Powloski, J., "Vehicle Body Engineering", Business Books Ltd., 1998.
- James E Duffy, "Body Repair Technology for 4-Wheelers", Cengage Learning, 2009.

**REFERENCES:**

- Giles, G.J., "Body construction and design", Illiffe Books Butterworth & Co., 1991.
- John Fenton, "Vehicle Body layout and analysis", Mechanical Engg. Publication Ltd., London, 1992.
- Braithwaite, J.B., "Vehicle Body building and drawing", Heinemann Educational Books Ltd., London, 1997.
- Dieler Anselm., The passenger car body, SAE International, 2000

**AT6811**

**PROJECT WORK**

**L T P C**  
**0 0 12 6**

**OBJECTIVES:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 180 PERIODS**

**OUTCOMES:**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**GE6075**

**PROFESSIONAL ETHICS IN ENGINEERING**

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

**OBJECTIVES:**

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES**

**10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II ENGINEERING ETHICS**

**9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION**

**9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS**

**9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

**UNIT V GLOBAL ISSUES****8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

**TEXT BOOKS:**

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

**REFERENCES:**

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" McGraw Hill education, India Pvt. Ltd., New Delhi 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011

**Web sources:**

1. [www.onlineethics.org](http://www.onlineethics.org)
2. [www.nspe.org](http://www.nspe.org)
3. [www.globalethics.org](http://www.globalethics.org)
4. [www.ethics.org](http://www.ethics.org)

**AT6001****AUTOMOTIVE AIR-CONDITIONING****L T P C  
3 0 0 3****OBJECTIVES**

- 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 AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS****9**

Purposes of Heating, Ventilation and Air Conditioning- Environmental Concerns- Ozone layer depletion- Location of air conditioning components in a car – Schematic layout of a vehicle refrigeration system. Psychrometry – Basic terminology and Psychrometric mixtures- Psychrometric Chart- Related problems

**UNIT II AUTOMOTIVE COOLING AND HEATING SYSTEM****9**

Vehicle Refrigeration System and related problems- Fixed thermostatic and Orifice tube system- Variable displacement thermostatic and Orifice tube system- Vehicle air conditioning operation

Types of compressor- Compressor Clutches- Compressor Clutch electrical circuit- Compressor lubrication- Condensers- Evaporators- Expansion devices- Evaporator temperature and pressure controls- receiver-drier- Accumulators- refrigerant hoses, Connections and other assemblies- Heating system

**UNIT III AIR-CONDITIONING CONTROLS, DELIVERY SYSTEM AND REFRIGERANTS 9**

Types of Control devices- Preventing Compressor damage- Preventing damage to other systems- Maintaining driveability- Preventing Overheating  
Ram air ventilation- Air delivery Components- Control devices- Vacuum Controls  
Containers – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

**UNIT IV AUTOMATIC TEMPERATURE CONTROL 9**

Different types of sensors and actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system

**UNIT V SYSTEM SERVICING AND TESTING 9**

Special tools for servicing vehicle air conditioning – Diagnosing components and air conditioning systems- Diagnosing cooling system- Air delivery system- Automatic temperature Control system diagnosis and service

**TOTAL : 45 PERIODS**

**OUTCOMES**

- Upon the completion of the course, the student should understand the basic of vehicle air-conditioning system, its components, working principle, control mechanism, service etc.

**TEXT BOOKS:**

1. Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and Air Conditioning systems", Classroom Manual, Pearson Prentice Hall, 2004
2. Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and Air Conditioning systems", Shop Manual, Pearson Prentice Hall, 2004
3. William H Crouse and Donald L Anglin, "Automotive Air conditioning", McGraw Hill Inc., 1990.

**REFERENCES:**

1. Mitchell Information Services, Inc., "Mitchell Automatic Heating and Air Conditioning Systems", Prentice Hall Inc., 1989.
2. Paul Weisler, "Automotive Air Conditioning", Reston Publishing Co. Inc., 1990.
3. McDonald,K.L., "Automotive Air Conditioning", Theodore Audel series, 1978.
4. Goings,L.F., "Automotive Air Conditioning", American Technical services, 1974.

**AT6002**

**ALTERNATIVE FUELS AND ENERGY SYSTEMS**

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

**OBJECTIVES:**

- To know about the types of alternative fuels and energy sources for IC engines.

**UNIT I ALCOHOLS AS FUELS 9**

Introduction to alternative fuels. - Need for alternative fuels - Availability of different alternative fuels for SI and CI engines. Alcohols as fuels. Production methods of alcohols. Properties of alcohols as

fuels. Methods of using alcohols in CI and SI engines. Blending, dual fuel operation, surface ignition and oxygenated additives. Performance emission and combustion characteristics in CI and SI engines.

**UNIT II VEGETABLE OILS AS FUELS 9**

Various vegetable oils and their important properties. Different methods of using vegetable oils engines – Blending, preheating Transesterification and emulsification of Vegetable oils - Performance in engines – Performance, Emission and Combustion Characteristics in diesel engines.

**UNIT III HYDROGEN AS ENGINE FUEL 9**

Production methods of hydrogen. Combustive properties of hydrogen. Problems associated with hydrogen as fuel and solutions. Different methods of using hydrogen in SI and CI engines. Performance, emission and combustion analysis in engines. Hydrogen storage - safety aspects of hydrogen.

**UNIT IV BIOGAS, NATURAL GAS AND LPG AS FUELS 9**

Production methods of Biogas, Natural gas and LPG. Properties studies. CO<sub>2</sub> and H<sub>2</sub>S scrubbing in Biogas., Modification required to use in SI and CI Engines- Performance and emission characteristics of Biogas, NG and LPG in SI and CI engines.

**UNIT V ELECTRIC, HYBRID AND FUEL CELL VEHICLES 9**

Layout of Electric vehicle and Hybrid vehicles – Advantages and drawbacks of electric and hybrid vehicles. System components, Electronic control system – Different configurations of Hybrid vehicles. Power split device. High energy and power density batteries – Basics of Fuel cell vehicles.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- On completion of the course, the student will understand the various alternative fuels available, its properties, performance characteristics, combustion characteristics, emission characteristics, engine modifications required etc.,

**TEXT BOOK:**

1. Ayhan Demirbas, '**Biodiesel A Realistic Fuel Alternative for Diesel Engines**', Springer-Verlag London Limited 2008,ISBN-13: 9781846289941

**REFERENCES:**

1. Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, **The Biodiesel Handbook**, AOCS Press Champaign, Illinois 2005.
2. Richard L Bechtold P.E., **Alternative Fuels Guide book**, Society of Automotive Engineers, 1997 ISBN 0-76-80-0052-1.
3. Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).
4. Science direct Journals (**Biomass & Bio energy, Fuels, Energy, Energy conversion Management, Hydrogen Energy**, etc.) on biofuels.
5. Devaradjane. Dr. G., Kumaresan. Dr. M., "Automobile Engineering", AMK Publishers, 2013.

**OBJECTIVES:**

- knowledge in basic of vibration and noise
- Understanding the effect of noise an human comfort and environment
- Knowing the methods of vibration and noise measurement.

**UNIT I FUNDAMENTALS OF ACOUSTICS AND NOISE, VIBRATION 8**

Theory of Sound—Predictions and Measurement, Sound Sources, Sound Propagation in the Atmosphere, Sound Radiation from Structures and Their Response to Sound, General Introduction to Vibration, Vibration of Simple Discrete and Continuous Systems, Random Vibration, Response of Systems to Shock, Passive Damping

**UNIT II EFFECTS OF NOISE, BLAST, VIBRATION, AND SHOCK ON PEOPLE 7**

General Introduction to Noise and Vibration Effects on People and Hearing Conservation, Sleep Disturbance due to Transportation Noise Exposure, Noise-Induced Annoyance, Effects of Infrasound, Low-Frequency Noise, and Ultrasound on People, Auditory Hazards of Impulse and Impact Noise, Effects of Intense Noise on People and Hearing Loss, Effects of Vibration on People, Effects of Mechanical Shock on People, Rating Measures, Descriptors, Criteria, and Procedures for Determining Human Response to Noise.

**UNIT III TRANSPORTATION NOISE AND VIBRATION—SOURCES, PREDICTION, AND CONTROL 10**

Introduction to Transportation Noise and Vibration Sources, Internal Combustion Engine Noise Prediction and Control—Diesel, Exhaust and Intake Noise and Acoustical Design of Mufflers, Tire/Road Noise—Generation, Measurement, and Abatement, Aerodynamic Sound Sources in Vehicles—Prediction and Control, Transmission and Gearbox Noise and Vibration Prediction and Control, Brake Noise Prediction and Control.

**UNIT IV INTERIOR TRANSPORTATION NOISE AND VIBRATION SOURCES - PREDICTION AND CONTROL 10**

Introduction to Interior Transportation Noise and Vibration Sources, Automobile, Bus, and Truck Interior Noise and Vibration Prediction and Control, Noise and Vibration in Off-Road Vehicle Interiors- Prediction and Control,

**UNIT V NOISE AND VIBRATION TRANSDUCERS, ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES 10**

General Introduction to Noise and Vibration Transducers, Measuring Equipment, Measurements, Signal Acquisition, and Processing, Acoustical Transducer Principles and Types of Microphones, Vibration Transducer Principles and Types of Vibration Transducers, Sound Level Meters, Noise Dosimeters, Analyzers and Signal Generators, Equipment for Data Acquisition, Noise and Vibration Measurements, Determination of Sound Power Level and Emission Sound Pressure Level, Sound Intensity Measurements, Noise and Vibration Data Analysis, Calibration of Measurement Microphones, Calibration of Shock and Vibration Transducers, Metrology and Traceability of Vibration and Shock Measurements.

**TOTAL : 45 PERIODS****OUTCOMES:**

- At the end of the course, the student will understand the sources, effects, prediction, control techniques, measurement techniques of noise, vibration pertain to an automobile.

**TEXT BOOKS:**

1. Clarence W. de Silva , “Vibration Monitoring, Testing, and Instrumentation “,CRC Press, 2007

- David A. Bies and Colin H. Hansen "Engineering Noise Control: Theory and Practice" Spon Press, London, 2009

**REFERENCES:**

- Allan G. Piersol, Thomas L. Paez "Harris' Shock and Vibration Handbook", McGraw-Hill, New Delhi, 2010
- Colin H Hansen "Understanding Active Noise Cancellation", Spon Press, London 2003
- Matthew Harrison "Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles", Elsevier Butterworth-Heinemann, Burlington, 2004

**AT6004**

**ADVANCE THEORY OF IC ENGINES**

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

**OBJECTIVES:**

- Knowledge in usage of software for simulating the performance of IC engines
- Acquiring ability to simulate the various types combustion processes of IC engines.
- Knowledge in performance simulation of IC engines.

**UNIT I COMBUSTION OF FUELS**

**9**

Chemical composition and molecular structure of hydrocarbon fuels. Combustion Stoichiometry of hydrocarbon fuels – Chemical energy and heat of reaction calculations – Chemical equilibrium and adiabatic flame temperature calculation. Theory of SI and CI engine combustion – Flame velocity and area of flame front. Fuel spray characteristics – droplet size, depth of penetration and atomization.

**UNIT II ENGINE CYCLE ANALYSIS**

**8**

Ideal air, fuel air cycle and actual cycle analysis. Progressive combustion analysis in SI engines. Parametric studies on work output, efficiency and other engine performance.

**UNIT III COMBUSTION MODELLING**

**10**

Basic concepts of engine simulation – Governing equations, Classification of engine models- Thermodynamic models for Intake and exhaust flow process – Quasi steady flow - Filling and emptying - Gas dynamic Models. Thermodynamic based in cylinder models for SI engine and CI engines.

**UNIT IV NON-CONVENTIONAL IC ENGINES**

**9**

Concept of L.H.R. engine and its recent developments. Variable compression ratio engine and its use in engine research. Wankel rotary combustion engine. Dual fuel engine concept for multi fuel usage in CI engines - performance studies on dual fuel engine. Free piston engine. Stratified charge and lean burn engines. Locomotive and marine engines.

**UNIT V COMBUSTION ANALYSIS IN IC ENGINES**

**9**

Photographic studies of combustion processes – Analysis of Pressure crank angle diagrams in SI and CI engines. Knock study for Pressure crank angle histories. Apparent heat release rate and Wiebe's law analysis for combustion. Calculation of Ignition delay and combustion duration. – Hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- At the end of the course, the student can able to model and simulate the engine cycle, perform combustion analysis, instruments used in measurement, recent developments in the IC engines.

## TEXT BOOKS:

1. Ganesan,V., "Internal combustion engines", Tata McGraw Hill Publishing Co., 1994.
2. Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderabad, 1996.

## REFERENCES:

1. Ramalingam. K.K., "Internal combustion engine", scitech publications, Chennai, 2003.
2. Ganesan,V., "Compute Simulation of Compression Ignition engine process", Universities Press (India) Ltd., Hyderabad, 1996.
3. John,B., Heywood, "Internal Combustion Engine Fundamentals", McGraw Hill Publishing Co., New York, 1990.
4. Benson,R.S., Whitehouse,N.D., "Internal Combustion Engines", Pergamon Press, Oxford, 1979.

**AT6005**

**METROLOGY AND INSTRUMENTATION**

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

## OBJECTIVES :

- Knowledge in usage of software to measure parameters like speed, position, velocity, pressure, force, torque, temperature etc

## **UNIT I INTRODUCTION TO MEASUREMENTS AND SENSORS 9**

Sensors: Functions- Classifications- Main technical requirement and trends Units and standards- Calibration methods- Classification of errors- Error analysis- Limiting error- Probable error- Propagation of error- Odds and uncertainty- principle of transduction- Classification. Static characteristics- mathematical model of transducers- Zero, First and Second order transducers- Dynamic characteristics of first and second order transducers for standard test inputs.

## **UNIT II VARIABLE RESISTANCE AND INDUCTANCE SENSORS 9**

Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT

## **UNIT III VARIABLE AND OTHER SPECIAL SENSORS 9**

Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

## **UNIT IV AUTOMOTIVE PRESSURE AND FORCE/TORQUE SENSOR 9**

### **Pressure Sensor:**

Typical automotive applications- Thick film pressure sensor- Semiconductor pressure sensor- Integrated silicon intake-manifold pressure sensor-Integrated silicon combustion-pressure sensor- Piezo electric sensor-High pressure sensor with metal diaphragm.

### **Force/Torque Sensor:**

Typical automotive applications- Magneto elastic bearing-pin sensor- Magneto elastic tension/compressive-force sensor according to the cross-ductor principle – Basic principle of torque measurement –Stress and Angle measuring torque sensor



**UNIT V AUTOMOTIVE POSITION AND RPM/VELOCITY SENSORS 9**

**Position Sensors:-** Typical automotive applications- Wiper potentiometers- Short-circuiting ring sensor- Half-differential sensor- Eddy-current pedal-travel sensor- Integrated Hall IC's - Hall acceleration sensor- Knock sensors-RPM and Velocity Sensors: - Inductive rotational speed sensor- Hall effect sensor

**Temperature Sensors:-** Typical automotive applications -Sintered-Ceramic resistors-Thin film resistors-Thick film resistors- Monocrystalline silicon semiconductor resistor- Thermopile sensors

**Flow Sensors:-** Ultrasonic flow sensors-Pitot tube air-flow sensor- Hot wire air-mass flow meter- Micro mechanical hot-film air-mass flow meter- Lambda sensor -Imaging sensor-Rain Sensor  
Introduction to MEMs

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- At the end of the course, the students will aware the various instruments that are available to measure parameters like speed, position, velocity, pressure, force, torque, temperature etc.

**TEXT BOOKS:**

1. Doebelin E.O, "Measurement Systems : Applications and Design", 5<sup>th</sup> Edition, Tat McGraw-Hill Publishing Co,2007
2. Robert Brandy, " Automotive Electronics and Computer System", Prentice Hall, 2001
3. William Kimberley," Bosch Automotive Handbook", 6<sup>th</sup> Edition, Robert Bosch GmbH, 2004

**REFERENCES:**

1. Bentley J.P , " Principles of Measurement Systems", 4<sup>th</sup> Edition, Addison Wesley Longman Ltd., U.K, 2004
2. Patranabis.D, " Sensors and Transducers", 2<sup>nd</sup> Edition, Prentice Hall India Ltd, 2003
3. Murthy D.V.S, "Transducers and Instrumentation", Prentice Hall of India, 2007
4. Neubert H.K.P.," Instrument Transducers- An Introduction to their Performance and Design" , Oxford University Press, Cambridge, 2003

**AT6006 MANUFACTURING OF AUTOMOTIVE COMPONENTS L T P C  
3 0 0 3**

**OBJECTIVES:**

- To impart knowledge on basic principle and production methods of automotive components.

**UNIT I CASTED ENGINE COMPONENTS 9**

Material selection and Manufacturing methods for Piston, Piston rings, Cylinder block, wet and dry liners, Engine head, Oil pan, Carburetors. Thermal barrier coating of Engine head and valves.

**UNIT II FORGED ENGINE COMPONENTS 8**

Material selection and Manufacturing methods for Crank shaft, Connecting rod, Cam shaft, valve, Piston pin, Push rod, Rocker arm, tappets, spark plug.

**UNIT III TRANSMISSION SYSTEM 10**

Material selection and Manufacturing methods for Clutch – Clutch lining – Gear Box – Gear – Propeller Shaft – Differential – Axle Shaft – Bearing – fasteners – Wheel drum.  
Methods of Gear manufacture – Gear hobbing and gear shaping machines - gear generation - gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching.

**UNIT IV VEHICLE CHASSIS****8**

Material selection and manufacturing methods for chassis, dead axle, leaf spring, coil spring and shock absorbers – wheel housing – steering system, Brake shoes, wheel rim, Tyres. Heat treatment procedures.

**UNIT V RECENT DEVELOPMENTS****10**

Surface treatment – Plastics – Plastics in Automobile vehicles – Processing of plastics - Emission control system – catalytic converter – Hydro forming of exhaust manifold and lamp housing – stretch forming of Auto body panels – MMC liners – Selection of materials for Auto components. Use of Robots in Body weldment.

**TOTAL : 45 PERIODS****OUTCOMES**

- Upon completion of this course the student can able to use the basic principle and production methods of automotive components

**TEXT BOOK:**

1. Heldt.P.M, "High speed combustion engines", Oxford publishing Co., New York, 1990.

**REFERENCES:**

1. Kirpal Singh, 'Automobile Engineering", Vol. I & II, Standard Publishers, New Delhi, 1997.
2. Newton and steels, the motor vehicle, ELBS, 1990
3. Serope Kalpakjian and Steven R. Schmid, "Manufacturing Processes for Engineering Materials", Fourth Edition, Pearson Education publications – 2003
4. Gupta K.M. "Automobile Engineering" Vol.I & II, Umesh Publishers, 2000.

**ME6006****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 AND DRAWING DIES****10**

Difference between bending 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 redrawing and combination dies – Blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies.

**UNIT V OTHER FORMING TECHNIQUES****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.

**TOTAL: 45 PERIODS**

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

**OUTCOMES:**

- Upon completion of this course, the students can able to design jigs, fixtures and press tools.

**TEXT BOOKS:**

1. Joshi, P.H. “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.
2. Joshi P.H “Presstools - Design and Construction”, wheels publishing, 1996

**REFERENCES:**

1. Venkataraman. K., “Design of Jigs Fixtures & Press Tools”, Tata McGraw Hill, New Delhi, 2005.
2. Donaldson, Lecain and Goold “Tool Design”, III rd Edition Tata McGraw Hill, 2000.
3. Kempster, “Jigs and Fixture Design”, Hoddes and Stoughton – Third Edition 1974.
4. Hoffman “Jigs and Fixture Design”, Thomson Delmar Learning, Singapore, 2004.
5. ASTME Fundamentals of Tool Design Prentice Hall of India.
6. Design Data Hand Book, PSG College of Technology, Coimbatore, Kalaikathir achchagam, 2011.

**ME6010****ROBOTICS****L T P C  
3 0 0 3****OBJECTIVES:**

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

**UNIT I FUNDAMENTALS OF ROBOT****6**

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 their Functions-Need for Robots-Different Applications.

**UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS****9**

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End



**AT6007**

**NEW GENERATION AND HYBRID VEHICLES**

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

**OBJECTIVES:**

- 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**

**OUTCOMES:**

- Upon completion of this course the student will familiar in the recent development pertain to energy system, vehicle operation, newer vehicle, recent technologies in the area of suspension systems, brakes, aerodynamics etc

**TEXT BOOKS:**

1. Heinz, "Modern Vehicle Technology" Second Edition, Bu
2. Bosch Hand Book, SAE Publication, 2000

**REFERENCES**

1. Light weight electric for hybrid vehicle design.
2. Advance hybrid vehicle power transmission, SAE.
3. Noise reduction, Branek L.L., McGraw Hill Book company, New York, 1993.

**AT6008**

**COMPUTER SIMULATION OF IC ENGINES**

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

**OBJECTIVES:**

- To impart knowledge in simulating IC engine processes. The detailed concept of air standard, fuel air cycle, progressive and actual cycle simulation of SI engine will be taught to the students. At the end of the course the students will have command over simulation of IC engine process.

**UNIT I INTRODUCTION 9**  
Introduction to Simulation, Advantages of computer simulation, Classification of engine models. Intake and exhaust flow models – Quasi steady flow - Filling and emptying - Gas dynamic Models. Thermodynamic based in cylinder models. Step by step approach in SI engine simulation.

**UNIT II COMBUSTION AND STOICHIOMETRY 9**  
Reactive processes, Heat of reaction, measurement of URP, measurement of HRP. Introduction - combustion equation for hydrocarbon fuels. Calculation of minimum air required for combustion, excess air supplied and stoichiometric air required for complete combustion. Conversion of volumetric analysis to mass analysis.

**UNIT III ADIABATIC FLAME TEMPERATURE 9**  
Introduction, complete combustion in C-H-N-O systems, constant volume adiabatic combustion, constant pressure adiabatic combustion, calculation of adiabatic flame temperature, isentropic changes of state. SI Engine simulation with air as working medium, deviation between actual and ideal cycle.

**UNIT IV SI ENGINE SIMULATION WITH ADIABATIC COMBUSTION 9**  
Introduction, Engine details, temperature drop due to fuel vaporization, full throttle operation, work output and efficiency calculation, part-throttle operation, engine performance at part throttle, super charged operation, SI Engines simulation with progressive combustion. Wiebe's law combustion analysis.

**UNIT V SI ENGINE SIMULATION WITH GAS EXCHANGE PROCESS 9**  
Introduction, gas exchange process, Heat transfer process, friction calculations, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram, brake power, brake thermal efficiency, effect of speed on performance.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- The student will be familiar with the basics of simulation, combustion process, SI Engine modeling and simulation process

**TEXTBOOKS:**

1. Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderabad, 1996.

**REFERENCES:**

1. John. B. Heywood, "Internal Combustion Engines", Tata McGraw Hill Co., Newyork, 1988.
2. Benson.R.S., Whitehouse.N.D., "Internal Combustion Engines", Pergamon Press, oxford, 1979
3. Ramoss. A.L., "Modelling of Internal Combustion Engines Processes", McGraw Hill Publishing Co., 1992.
4. Ashley Campbel, "Thermodynamic analysis of combustion engines", John Wiley & Sons, New York, 1986.

**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****OUTCOMES:**

- Upon completion of this course, the students can able to analyse the fiber reinforced Laminate for optimum design
- Apply classical laminate theory to study and analyse the residual stresses in Laminate.

**TEXT BOOKS:**

1. Gibson, R.F., "Principles of Composite Material Mechanics", Second Edition, McGraw-Hill, CRC press in progress,1994.
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", Manel 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.

**AT6009****AUTOMOTIVE AERODYNAMICS****L T P C  
3 0 0 3****OBJECTIVES :**

- At the end of the course, the students will be able to apply basic principles of aerodynamics for the design of vehicle body.

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

Scope, historical developments, fundamental of fluid mechanics, flow phenomenon related to vehicles, external and internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics.

**UNIT II AERODYNAMIC DRAG OF CARS****9**

Cars 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 CARS****9**

Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners. Case studies on modern vehicles.

**UNIT IV VEHICLE HANDLING****9**

The origin of forces and moments on a vehicle, lateral stability 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 and racing cars.

**UNIT V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS****9**

Introduction, principle 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. CFD analysis.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students will understand the fundamentals of aerodynamics, vehicle body optimisation, measuring aerodynamics forces etc.

**TEXT BOOK:**

1. Hucho .W.H., "Aerodynamic of Road Vehicles", Butterworths Co., Ltd., 1997



## REFERENCES :

1. A. Pope, "Wind Tunnel Testing", 2<sup>nd</sup> Edition, John Wiley & Sons New York, 1974.
2. "Automotive Aerodynamic", Update SP-706, Society of Automotive Engineers Inc, 1987
3. "Vehicle Aerodynamics", SP-1145, Society of Automotive Engineers Inc, 1996.

**AT6010**

**OFF ROAD VEHICLES**

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

## OBJECTIVES:

- At the end of the course, the students will be able to understand the various Off road vehicle and their systems and features

### **UNIT I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES 6**

Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multi-axle vehicles.

### **UNIT II EARTH MOVING MACHINES 10**

Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, excavators, backhoe loaders, scrapers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.

### **UNIT III SCRAPERS, GRADERS, SHOVELS AND DITCHERS 10**

Scrapers, elevating graders, motor graders, self powered scrapers and graders, Power shovel, revolving and stripper shovels – drag lines – ditchers – capacity of shovels.

### **UNIT IV FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES 8**

Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.

### **UNIT V VEHICLE SYSTEMS, FEATURES 11**

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper. Design aspects on dumper body, loader bucket and water tank of sprinkler.

**TOTAL: 45 PERIODS**

## OUTCOMES:

- At the end of the course, the students will understand the types, special features, design methodology, working principle, application of various off – road vehicles.

## TEXT BOOKS:

1. Robert L Peurifoy, "Construction, planning, equipment and methods" Tata McGraw Hill Publishing company Ltd.
2. Nakra C.P., "Farm machines and equipments" Dhanparai Publishing company Pvt. Ltd.
3. Abrosimov.K. Bran berg.A and Katayer.K., "Road making machinery", MIR Publishers, Moscow, 1971.
4. SAE Handbook Vol. III., Society of Automotive Engineers, 1997
5. Wong.J.T., "Theory of Ground Vehicles", John Wiley & Sons, New York, 1987.

## REFERENCES:

1. Ia. S. Ageikin, "Off the Road Wheeled and Combined Traction Devices: Theory and Calculation", Ashgate Publishing Co. Ltd. 1988.

2. Schulz Erich.J, "Diesel equipment I & II", McGraw Hill company, London, 1982.
3. Bart H Vanderveen, "Tanks and Transport Vehicles", Frederic Warne and Co Ltd., London.
4. Satyanarayana. B., "Construction planning and equipment", standard publishers and distributors, New Delhi, 1985.

**AT6011**

**AUTOMOTIVE SAFETY**

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**OBJECTIVES:**

- 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**

**OUTCOMES:**

- The student will be familiar in various systems that enhances vehicle safety, passenger comfort, recent technologies in automobile field etc.,

**TEXT BOOKS**

1. Bosch, "Automotive Handbook", 8<sup>th</sup> Edition, SAE publication, 2011.
2. Powloski. J., "Vehicle Body Engineering", Business books limited, London, 1969.

**REFERENCES:**

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

**OBJECTIVES:**

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

**UNIT I CARBURETION****10**

Properties of air-petrol mixtures, Air fuel ratio requirements or SI Engines working of a simple fixed venturi and constant vacuum carburetor, 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****9**

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****OUTCOMES:**

- At the end of the course, the student will be familiar with the auxiliary system, its roles, functionality, construction, working principle etc.

**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.

**OBJECTIVES:**

- 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****OUTCOMES:**

Upon completion of the course, students will

- Know about different aspects related to transport system and management.
- Features of scheduling, fixing the fares
- Know about the motor vehicle act and maintenance aspects of transport.

**TEXT BOOKS:**

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

**REFERENCES:**

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

**OBJECTIVES :**

- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

**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 Games, 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, Taxation – Income Tax, Excise Duty – Sales Tax.

**UNIT V SUPPORT TO ENTREPRENEURS****9**

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

**TOTAL : 45 PERIODS****OUTCOMES:**

- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

**TEXT BOOKS :**

- Khanka. S.S, “Entrepreneurial Development” S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
- Donald F Kuratko, “Entrepreneurship – Theory, Process and Practice”, 9<sup>th</sup> Edition, Cengage Learning, 2014.

**REFERENCES :**

- Hisrich R D, Peters M P, “Entrepreneurship” 8<sup>th</sup> Edition, Tata McGraw-Hill, 2013.
- Mathew J Manimala, Entrepreneurship theory at cross roads: paradigms and praxis”, 2<sup>nd</sup> Edition, Dream tech, 2005.
- Rajeev Roy, ‘Entrepreneurship’, 2<sup>nd</sup> Edition, Oxford University Press, 2011.
- EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development”, Institute of India, Ahmadabad, 1986.

**OBJECTIVES:**

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

**UNIT I LINEAR MODELS****15**

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

**UNIT II TRANSPORTATION MODELS AND NETWORK MODELS****8**

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

**UNIT III INVENTORY MODELS****6**

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

**UNIT IV QUEUEING MODELS****6**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

**UNIT V DECISION MODELS****10**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

**TEXT BOOK:**

- Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003

**REFERENCES:**

- Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
- Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 1990.
- Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
- Hillier and Libeberman, "Operations Research", Holden Day, 1986
- Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
- Tulsian and Pasdey V., "Quantitative Techniques", Pearson – Asia 2002.

**OBJECTIVES:**

- To facilitate the understanding of Quality Management principles and process.

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

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

**UNIT II TQM PRINCIPLES****9**

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND 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 AND TECHNIQUES II****9**

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

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

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

**TOTAL: 45 PERIODS****OUTCOMES :**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

**TEXT BOOK:**

- Dale H. Besterfield, et al., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2006.

**REFERENCES:**

- James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
- Suganthi. L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
- Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.