



**B.Tech. (Full Time) – Automobile Engineering**

**Curriculum & Syllabus**

**2007-08**

**Faculty of Engineering & Technology  
SRM University  
SRM Nagar, Kattankulathur – 603 203**

**SRM UNIVERSITY**  
**B.Tech. AUTOMOBILE ENGINEERING**  
**CURRICULUM AND SYLLABUS**  
**2007-08**

**Semester I**

Code	Category	Course	L	T	P	C
<b>Theory</b>						
LE0101	G	English	1	0	2	2
MA0101	B	Mathematics – I	3	2	0	4
PH0101	B	Physics	3	0	0	3
CY0101	B	Chemistry	3	0	0	3
GE0101	E	Basic Engineering I	4	0	0	4
<b>Practical</b>						
PD0101	G	Personality Development – I*	0	0	2	0
GE0107	G	NSS / NCC / NSO / YOGA	0	0	2	1
GE0105	B	Computer Literacy	0	0	2	1
PH0103	B	Physics Laboratory	0	0	2	1
CY0103	B	Chemistry Laboratory	0	0	2	1
ME0120 / ME0130	E	Workshop Practice / Engineering Graphics	0/1	0	4	2/3
<b>Total</b>			<b>14/15</b>	<b>2</b>	<b>16</b>	<b>22/23</b>
<b>Total contact Hours</b>			<b>33/34</b>			

**Semester II**

Code	Category	Course	L	T	P	C
<b>Theory</b>						
GE0108	G	Value Education	1	0	0	1
MA0102	B	Mathematics - II	3	2	0	4
GE0102	B	Biology for Engineers	2	0	0	2
GE0104	B	Principles of Environmental Science	2	0	0	2
PH0102	B	Material Science	2	0	2	3
ME0102	B	Engineering Mechanics	3	2	0	4
GE0106	E	Basic Engineering - II	4	0	0	4
<b>Practical</b>						
PD0102	G	Personality Development – II*	0	0	2	0
ME0122	B	Computer Programming Practice	1	0	2	2
ME0130 / ME0120	E	Engineering Graphics / Workshop Practice	1/0	0	4	3/2
ME0124	E	Active Learning Laboratory	0	0	2	1
<b>Total</b>			<b>19/18</b>	<b>4</b>	<b>12</b>	<b>26/25</b>
<b>Total contact Hours</b>			<b>34/33</b>			

G: General programme comprising language/communication skills, humanities and social sciences, economics and principles of management, and NSS/NCC/NSO/YOGA.

B: Basic sciences comprising Computer Literacy with Numerical Analysis, Mathematics, Physics, and Chemistry.

E: Engineering Sciences and Technical Arts comprising Engineering Graphics, Workshop Practice, Basic Engineering, etc.

P: Professional subjects corresponding to the Branch of Studies, which will include core subjects, electives, and project work.

\* Audit course

**Semester III**

Code	Category	Course	L	T	P	C
<b>Theory</b>						
LE0201 / LE0203/LE0205	G	German Language Phase I / Japanese Language Phase I / French Language Phase I	2	0	0	2
MA0201	B	Mathematics - III	3	2	0	4
ME0201	E	Thermodynamics	2	2	0	3
IC0211	E	Electronics and Instrumentation	3	0	0	3
ME0203	P	Manufacturing Technology	3	0	0	3
ME0205	P	Fluid Mechanics	3	2	0	4
<b>Practical</b>						
PD0201	G	Personality Development - III	0	0	2	1
IC0217	E	Electronics and Instrumentation Laboratory	0	0	2	1
ME0221	P	Manufacturing Process Laboratory	0	0	2	1
ME0223	P	Fluid Dynamics Laboratory	0	0	2	1
<b>Total</b>			<b>16</b>	<b>6</b>	<b>8</b>	<b>23</b>
<b>Total contact Hours</b>			<b>30</b>			

**Semester IV**

Code	Category	Course	L	T	P	C
<b>Theory</b>						
LE0202 / LE0204/LE0206	G	German Language Phase II / Japanese Language Phase II / French Language Phase II	2	0	0	2
MA0202	E	Numerical Methods	3	2	0	4
ME0204	P	Mechanics of Solids	3	2	0	4
ME0206	P	Applied Thermal Engineering	3	2	0	4
ME0208	P	Machines and Mechanisms	3	2	0	4
ME0210	P	Computer Aided Design and Analysis	3	0	0	3
<b>Practical</b>						
PD0202	G	Personality Development - IV	0	0	2	1
ME0222	P	Strength of Material Laboratory	0	0	2	1
ME0224	P	Computer Aided Design Laboratory	0	0	2	1
ME0226	P	Manufacturing and Assembly Drawing	1	0	3	2
<b>Total</b>			<b>18</b>	<b>8</b>	<b>9</b>	<b>26</b>
<b>Total contact Hours</b>			<b>35</b>			

**Semester V**

Code	Category	Course	L	T	P	C
<b>Theory</b>						
ME0301	P	Fundamentals of Vibration and noise	3	2	0	4
ME0307	P	Materials Technology	3	0	0	3
AE0301	P	Theory of Automotive Engines	3	2	0	4
AE0303	P	Automotive Chassis	3	2	0	4
	P	Elective - I	3	0	0	3
<b>Practical</b>						
PD0301	G	Personality Development - V	1	0	2	2
ME0321	P	Machine Dynamics Laboratory	0	0	2	1
ME0325	P	Materials Technology Laboratory	0	0	2	1
AE0321	P	Automotive Engine and Chassis Components Lab	0	0	2	1
ME0327	P	Comprehension I	0	2	0	1
AE0325	P	Industrial Training – I <sup>#</sup>	0	0	2	1
AE0327 / -	P	Computer Skill <sup>*</sup> / -	0	0	4/-	2/-
<b>Total</b>			<b>16</b>	<b>8</b>	<b>14/9</b>	<b>27/25</b>
<b>Total contact Hours</b>			<b>38/33</b>			

<sup>#</sup> An industrial training of minimum two weeks has to be undergone by the student in the winter / summer vacation of the III / IV semester.

\* Each student shall undergo a minimum of 60 hours of training in one or more engineering software relevant to the branch of study.

#### Semester VI

Code	Category	Course	L	T	P	C
<b>Theory</b>						
ME0306	P	Fluid Power Control	3	0	0	3
AE0302	P	Automotive Engine Systems	3	0	0	3
AE0304	P	Automotive Electrical Systems	3	0	0	3
AE0306	P	Automotive Transmission	3	2	0	4
	P	Elective - II	3	0	0	3
<b>Practical</b>						
PD0302	G	Personality Development - VI	1	0	2	2
AE0322	P	Vehicle Testing Lab	0	0	2	1
AE0324	P	Engine and Fuel Testing Laboratory	0	0	2	1
AE0326	P	Comprehension II	0	2	0	1
- / AE0328	P	- / Computer Skill*	0	0	- / 4	- / 2
<b>Total</b>			<b>15</b>	<b>4</b>	<b>6/10</b>	<b>21/23</b>
<b>Total contact Hours</b>			<b>25/29</b>			

#### Semester VII

Code	Category	Course	L	T	P	C
<b>Theory</b>						
ME0401	G	Economics and Principles of Management	3	0	0	3
ME0407	P	Computer Aided Manufacturing	3	0	0	3
AE0401	P	Alternative Fuels and Energy Systems	3	0	0	3
AE0403	P	Vehicle Body Engineering and Safety	3	0	0	3
	P	Elective III	3	0	0	3
<b>Practical</b>						
ME0423	P	Computer Aided Manufacturing Laboratory	0	0	2	1
AE0421	P	Engine Reconditioning Laboratory	0	0	2	1
AE0423	P	Industrial Training – II <sup>##</sup>	0	0	2	1
<b>Total</b>			<b>15</b>	<b>0</b>	<b>6</b>	<b>18</b>
<b>Total contact Hours</b>			<b>21</b>			

<sup>##</sup> An industrial training of minimum two weeks has to be undergone by the student in the winter / summer vacation of the V / VI semester.

#### Semester VIII

Code	Category	Course	L	T	P	C
<b>Theory</b>						
	P	Elective IV	3	0	0	3
	P	Elective V	3	0	0	3
<b>Practical</b>						
AE0422	P	Project Work	0	0	17	8
<b>Total</b>			<b>6</b>	<b>0</b>	<b>17</b>	<b>14</b>
<b>Total contact Hours</b>			<b>23</b>			

#### Category wise Distribution of Credits

Semester	I	II	III	IV	V	VI	VII	VIII	Total	%
<b>Total Credits</b>	<b>22/23</b>	<b>26/25</b>	<b>23</b>	<b>26</b>	<b>27/25</b>	<b>21/23</b>	<b>18</b>	<b>14</b>	<b>177</b>	<b>100</b>
General	3	1	3	3	2	2	3	0	17	9.61
Basic Sciences	13	17	4	0	0	0	0	0	34	19.21
Engg. Sciences and Tech. Arts	6/7	8/7	7	4	0	0	0	0	25	14.12
Professional	0	0	9	19	25/23	19/21	15	14	101	57.06

**LIST OF ELECTIVES**

(Minimum of one each in Design, Manufacturing and Thermal category should be studied by each student)

**LIST OF ELECTIVES****(Each student should study a Minimum of one subject from each group)****ELECTIVE I**

AE 0001	Automotive Aerodynamics	3	0	0	3
AE 0002	Vehicle Dynamics	3	0	0	3
AE 0003	Computer Simulation of IC Engine Processes	3	0	0	3
AE 0004	Two and Three Wheeled Vehicles	3	0	0	3
AE 0005	Off road Vehicles	3	0	0	3
AE 0006	Tractor and Farm Equipments	3	0	0	3
AE 0007	Modern Vehicle Technology	3	0	0	3
AE 0008	Vehicle Performance Characteristics	3	0	0	3

**ELECTIVE II**

ME0021	Modern Manufacturing Techniques	3	0	0	3
ME0022	Precision Engineering	3	0	0	3
ME0023	Production Management	3	0	0	3
ME0024	Artificial Intelligence and Expert System	3	0	0	3
ME0025	Process Planning and Cost Estimation	3	0	0	3
ME0026	Tool Engineering and Design	3	0	0	3
ME0027	Flexible Manufacturing Systems	3	0	0	3
ME0028	Non Traditional Machining Techniques	3	0	0	3
ME0029	Foundry Engineering				

**ELECTIVE III**

ME0041	Combustion Engineering	3	0	0	3
ME0042	Gas Turbine Technology	3	0	0	3
ME0044	Fuel Cell Technology	3	0	0	3
ME0047	Refrigeration and Air Conditioning Systems	3	0	0	3
ME0048	Alternative Sources of Energy	3	0	0	3
AE0009	Automotive Air-Conditioning	3	0	0	3
AE0010	Automotive Pollution and Control	3	0	0	3

**ELECTIVE IV**

AE0011	Microprocessor Application in Automobiles	3	0	0	3
AE0012	Automotive Electronics	3	0	0	3
IC0461	Instrumentation and Control	3	0	0	3
MH0307	PLC and Data Acquisition Systems	3	0	0	3
IC0464	Microprocessor Based System Design	3	0	0	3
		3	0	0	3
		3	0	0	3
		3	0	0	3

**ELECTIVE V**

ME0061	Industrial Engineering	3	0	0	3
ME0062	Material Management	3	0	0	3
ME0063	Human Relations Management	3	0	0	3
ME0064	Entrepreneurship Development	3	0	0	3
ME0065	Facilities Planning	3	0	0	3
ME0066	Industrial Safety and Environment	3	0	0	3
ME0067	Supply Chain Management	3	0	0	3
ME0068	TQM and Reliability Engineering	3	0	0	3
ME0069	Marketing and Sales Management	3	0	0	3
AE0013	Vehicle Transport Management	3	0	0	3

## Semester - I

		L	T	P	C
LE 0101	ENGLISH	1	0	2	2
	Prerequisite				
	Nil				

### PURPOSE

To provide an adequate mastery of communicative English Language training primarily - reading and writing skills, secondarily listening and speaking skills.

### INSTRUCTIONAL OBJECTIVES

To provide language training to the engineering students which will enable them to understand and acquire knowledge in technical subjects.

### LISTENING

Listening Practice – Hints on Listening – Listening Practice

Note Taking: Note Taking Strategies

### SPEAKING

Definitions: Expressing Opinions (agreement / disagreement )-Offering Suggestions – Technical Definitions – Describing Objects – speaking practice.

Phonetics: Pronunciation-Phonetic Transcription-Stress-Intonation

### READING

Comprehension: Skimming-scanning-close reading-Comprehension – Transferring Information – Exercise – An unseen passage should be given and questions may be asked in the form of True or False statements, MCQ, short answers.

Transcoding : Interpreting tables, flow charts, piechart, bar diagram, tree diagram, graphs.

### WRITING

Art of Writing : Writing Language – Rules for effective writing – Technical Essay Writing – Exercise

Report Writing : Technical Writing – Lab Report – Exercise

Letter Writing : Formal Letters – Letter to the Editor – Letter Inviting Dignitaries – Letter of Application  
Curriculum Vitae – Placing an Order.

Dialogue Writing

### FOCUS ON AND COMMUNICATION AND “COMPUNICATION”

Communication : Basic Concepts – Process – Kinds – Routes – Forms – Factors – Barriers – Triangles  
Communication (Communicate through Computers – Power Point & Tele Conference).

### INTERNAL ASSESSMENT

Based on the submission of Assignments and test performance of the students marks will be awarded.

### TEXT BOOKS

1. Abraham Benjamin Samuel ‘*Practical Communication Communicative English LSRW2000*’– SRMEC – June 2006 Revised Edition.
2. Staff of the Department of Humanities and Social Science, Anna University, “*English for Engineers / Technologist Vol.-I*”. Orient Longman, 1990.

### REFERENCE BOOKS

1. Herbert. A. J. “*The structure of Technical English*” Orient Longman 1995.
2. Pickett and Laster, ‘*Technical English, Writing, Reading and Speaking*’, New York Harper and Row Publications, 1997.
3. “*Interactive course in phonetics and spoken English*” published by Acoustics Engineers(ACEN) 2002.

4. Munter, Mary, “*Business Communication Strategy and Skill*”, Prentice Hall Inc., New Jersey, 1987.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA 0101</b>	<b>MATHEMATICS -I</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>4</b>
	Prerequisite				
	Nil				

### **PURPOSE**

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

### **INSTRUCTIONAL OBJECTIVES**

At the end of the course, student should be able

1. To apply advanced matrix knowledge to Engineering problems.
2. To improve their ability in solving geometrical applications of differential calculus problems.
3. To equip themselves familiar with the functions of several variables.
4. To familiarize with the applications of differential equations.
5. To expose to the concept of three dimensional analytical geometry.

### **MATRICES**

Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties of eigen values – Caley – Hamilton theorem – Orthogonal reduction of a symmetric matrix to diagonal form – Orthogonal matrices – Reduction of quadratic form to canonical form by orthogonal transformations.

### **GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS**

Curvature – Cartesian and polar coordinates – Circle of curvature – Involute and Evolute – Envelopes – Properties of envelopes.

### **FUNCTIONS OF SEVERAL VARIABLES**

Function of two variables – Partial derivatives – Total differential – Taylor’s expansion – Maxima and Minima – Constrained Maxima and Minima by Lagrangean Multiplier method – Jacobians

### **ORDINARY DIFFERENTIAL EQUATIONS**

Simultaneous first order linear equations with constant coefficients – Linear equations of second order with constant and variable coefficients – Homogeneous equation of Euler type – Equations reducible to homogeneous form.

### **THREE DIMENSIONAL ANALYTICAL GEOMETRY**

Direction cosines and ratios – Angle between two lines – Equation of a plane – Equation of a straight line – Coplanar lines – Shortest distance between skew lines – Sphere – Tangent plane – Plane section of a sphere – Orthogonal spheres.

### **TEXT BOOK**

1. Grewal B.S, Higher Engg Maths, Khanna Publications, 38<sup>th</sup> Edition., Veerajan, T., *Engineering Mathematics*, Tata McGraw Hill Publishing Co., New Delhi, 2000.
2. Dr.V.Ramamurthy & Dr. Sundarammal Kesavan,” *Engineering Mathematics*” – Vol I & II Anuradha Publications, Revised Edition 2006.

### **REFERENCE BOOKS**

1. Kreyszig.E, “*Advanced Engineering Mathematics*”, 8<sup>th</sup> edition, John Wiley & Sons. Singapore, 2001.
2. Kandasamy P et al. “*Engineering Mathematics*”, Vol.I (4<sup>th</sup> revised edition), S.Chand &Co., New Delhi, 2000.
3. Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., “*Advanced Mathematics for Engineering students*”, Volume I (2<sup>nd</sup> edition), S.Viswanathan Printers and Publishers, 1992.
4. Venkataraman M.K., “*Engineering Mathematics*” – First Year (2<sup>nd</sup> edition), National Publishing Co., Chennai, 2000.

		L	T	P	C
<b>PH 0101</b>	<b>PHYSICS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

### PURPOSE

The purpose of this course is to develop scientific temper and analytical capability through learning physical concepts and their applications in engineering and technology. Comprehension of some basic physical concepts will enable the students to logically solve engineering problems.

### INSTRUCTIONAL OBJECTIVES

At the end of the course, the student will be able to:

1. Understand the general scientific concepts required for technology,
2. Apply the concepts in solving engineering problems,
3. Explain scientifically the new developments in engineering and technology, and
4. Get familiarized with the concepts, theories, and models behind many technological applications.

### PROPERTIES OF MATTER AND SOUND

**Properties of Matter:** Hooke's law – Twisting couple on a cylinder – Shafts – Torsion pendulum – Bending of beams – Bending moment – Uniform bending and non-uniform bending – I shape girder. **Sound:** Shock waves – Mach number (simple problems) – Ultrasonic production (magnetostriction and piezoelectric methods) and application – Acoustics of buildings – Sources and impacts of noise – Sound level meter – Control of noise pollution.

### ELECTROMAGNETISM AND MICROWAVES

**Electromagnetism:** Divergence, curl and gradient – Maxwell's equations – Wave equation for electromagnetic waves – Propagation in free space – Poynting vector – Rectangular and circular wave guides. **Microwaves:** Properties and applications – Generation by magnetron and reflex klystron oscillator – Travelling wave tube – Biological effects.

### OPTICS

**Photometry:** Principles and Lummer-Brodhun photometer. **Lasers:** Principles and characteristics – Types of lasers (CO<sub>2</sub>, excimer, NdYAG, GaAs, free electron) – Holographic mass storage. **Optical Fiber:** Principles – Physical structure and types – Optical fiber communication. **Photoelasticity:** Theory and applications.

### CRYSTAL PHYSICS AND CRYOGENICS

**Crystal Physics:** Crystal directions – Planes and Miller indices – Basic symmetry elements – Translational symmetry elements – Reciprocal lattice – Diamond and HCP crystal structure – Imperfections in crystals. **Cryogenics:** Methods of liquefaction of gases (cascade process, Linde's process, and adiabatic demagnetization process) – Measurement of cryogenic temperatures.

### ENERGY PHYSICS

Introduction to non-conventional energy sources – Solar cells – Thermoelectric power generators – Thermionic power generator – Magneto hydrodynamic power generator – Fuel cells (H<sub>2</sub>O<sub>2</sub>) – Solid state batteries (Lithium) – Low voltage and high voltage nuclear cells – Thermocouple based nuclear cell – Ultra capacitors.

### TEXT BOOKS

1. Arumugam, M., "Engineering Physics", 2<sup>nd</sup> edition, Anuradha Publishers, Kumbakonam, 2003.
2. Gaur and Gupta, "Engineering Physics", 7<sup>th</sup> edition, Dhandapani and Sons, New Delhi, 1997.
3. Thiruvadigal, J. D., Ponnusamy, S., Vasuhi, P. S. and Kumar, C., "Physics for Technologists", 5<sup>th</sup> edition, Vibrant Publication, Chennai, 2007.

### REFERENCE BOOKS

1. Vasudeva, A. S., "Modern Engineering Physics", Revised edition, S. Chand and Company Ltd., New Delhi, 2004.
2. Vasudevan, D. N., "Fundamentals of Magnetism and Electricity", 11<sup>th</sup> edition, S. Chand and Company Ltd., New Delhi, 1983.
3. Nair, K. P. R., "Atoms, Molecules and Lasers", Narosa Publishing House, New Delhi, 2006.
4. Pillai, S. O., "Solid State Physics", 5<sup>th</sup> edition, New Age International (P) Ltd., New Delhi, 2004.
5. Khan, B. H., "Non-Conventional Energy Resource"s, Mechanical Engineering Series, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006.



		L	T	P	C
<b>CY 0101</b>	<b>CHEMISTRY</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	<b>Prerequisite</b>				
	Nil				

### PURPOSE

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

### INSTRUCTIONAL OBJECTIVES

The students should be conversant with

1. The role of applied chemistry the field of engineering.
2. The knowledge of water quality parameters and the treatment of water.
3. The principles involves in corrosion and its inhibitions.
4. Important analytical techniques, instrumentation and the applications.
5. Knowledge with respect to the phase equilibria of different systems.

### TECHNOLOGY OF WATER

Water quality parameters: Physical, Chemical & Biological - Hardness of water – estimation of hardness (EDTA method & O. Hehner's method), Alkalinity – determination – disadvantages of using hard water in boilers: Scale, sludge formation – disadvantages – prevention – treatment: Internal conditioning – phosphate, calgon and carbonate conditioning methods – External: Zeolite, ion exchange methods - desalination – reverse osmosis and electrodialysis - domestic water treatment.

### CORROSION AND ITS CONTROL

Corrosion: Basic concepts – principles, mechanism of chemical, electrochemical corrosion – Pilling Bedworth rule – galvanic corrosion – differential aeration corrosion - pitting corrosion - stress corrosion - factors influencing corrosion.

Corrosion control: cathodic protection – sacrificial anodic method – corrosion inhibitor. Protective coatings: surface preparation for metallic coatings - electro plating and electroless Plating - chemical conversion coatings – anodizing, phosphating & chromate coating.

### PHASE EQUILIBRIA

Phase rule: Statement – explanation of the terms involved - one component system (water system only). Condensed phase rule - thermal analysis – two component systems: simple eutectic, Pb-Ag; Br, Cd - solid solution Cu-Ni and compound formation Mg-Zn - applications of eutectics.

### POLYMERS AND REINFORCED PLASTICS

Classification of polymers – types of polymerization reactions – mechanism of addition polymerization: free radical, ionic and ziegler – Natta - effect of structure on the properties of polymers – strength, plastic deformation, plastics elasticity and physical nature –Preparation and properties of important resins:- Polyethylene, PVC, PMMA, Polyester, Teflon Bakelite, Epoxy resins, compounding of plastics, moulding methods - injection, extrusion, compression and calendaring - reinforced plastics – FRP – Carbon, Graphite, Glass– applications.

### INSTRUMENTAL METHODS OF ANALYSIS

Basic principles, instrumentation of potentiometry, flame photometry – applications. Elementary theory – principle – instrumentation of UV – visible spectroscopy and atomic absorption spectroscopy and infrared spectroscopy.

### TEXT BOOKS

1. Jain.P.C and Monika Jain, “*Engineering Chemistry*”, Danpat Raj publishing company (P) Ltd, New Delhi – 2002.
2. Dara.S.S, “*Text book of Engineering Chemistr*”y, S. Chand & Company Ltd, New Delhi 2003.
3. Willard H.A., Merit L.L and Dean J.A., “*Instrumental methods of analysis*” 6<sup>th</sup> Edition Van Nostrand, 1986.

### REFERENCE BOOKS

1. Kuriacose J.C. and Rajaram J. “*Chemistry in Engineering and Technology*”, Volume II, Tata McGraw Hill p.b. Co., 1988.

2. Jeyalakshmi.R & Ramar. P, “*Engineering Chemistry*”, 1<sup>st</sup> Edition, Devi Publications, Chennai 2006.
3. Kamaraj.P & Arthanareeswari. M, “*Applied Chemistry*”, 2<sup>nd</sup> Edition, Sudhandhira Publications, 2003.
4. Arivalagan. K,” *Engineering Chemistry*”, 1<sup>st</sup> Edition, Mass publications, 2007.
5. P.Kamatchi, “*Applied Chemistry-I*”, Ponnuswamy publications, Chennai.
6. Dr. Helen P Kavitha , “*Engineering Chemistry – I*” ILA Publications, 2002.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0101</b>	<b>BASIC ENGINEERING - I</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>
	Prerequisite				
	Nil				

## **PART A CIVIL ENGINEERING**

### **PURPOSE**

To get exposed to the glimpses of Civil Engineering topics that is essential for an Engineer.

### **INSTRUCTIONAL OBJECTIVES**

1. To know about different materials and their properties.
2. Engineering aspects related to buildings.
3. To know about importance of Surveying.
4. To know about the transportation systems.
5. To get exposed to the rudiments of engineering related to Dams, Water Supply, Transportation system and Sewage Disposal.

### **BUILDING MATERIALS AND THEIR PROPERTIES**

Introduction - Civil Engineering – Building Materials – Brick, Stone, Cement, Steel, Concrete, timber – Properties – Uses. Units – Stress, strain and three moduli of elasticity – factor of safety - Centre of Gravity and Moment of Inertia for rectangle and circular section – simple problems.

### **BUILDINGS AND THEIR COMPONENTS**

Buildings – Classification - Components of buildings and their functions Foundations - functions – classification of foundations – Bearing capacity Floorings – functions - Types - Cement Concrete flooring – Mosaic flooring - Marble flooring Roofs - Types – Requirements – Madras Terrace roof. Tall structure – types of structural systems.

### **UTILITY AND SERVICES**

Surveying - Objective – Principles – Classification – Instruments used for Surveying. Dams - Purpose – Selection of site – Classification – Gravity dam (cross-section details only) Transportation system - Classification – Roadway - components – classification of roads - Railway – Cross-section of permanent way-components parts and functions. Docks and Harbour – classification – Terminology Bridges –components of a bridge - types of bridges. Water supply - Sources - Standards of drinking water (BIS) – elementary treatment methods – RO System Sewage disposal – Septic tank – function and components.

### **TEXT BOOKS**

1. Raju K.V.B., Ravichandran P.T., “*Basics of Civil Engineering*”, Ayyappa Publications, Chennai, 2000.
2. Ramesh Babu, “*Civil Engineering*“, VRB Publishers, Chennai, 2000.

### **REFERENCE BOOKS**

1. Rangwala, S.C., “*Engineering Materials*”, Charotar Publishing House, Anand, 1980.
2. National Building Code of India, Part V, “*Building Materials*”, 2005
3. Surendra Singh, “*Building Materials*”, Vikas Publishing Company, New Delhi, 1996

## **PART B MECHANICAL ENGINEERING**

### **PURPOSE**

To familiarize the students with the basics of Mechanical Engineering.

### **INSTRUCTIONAL OBJECTIVES**

To familiarize with

1. The basic machine elements
2. The Sources of Energy and Power Generation
3. The various manufacturing processes

## MACHINE ELEMENTS

**Springs:** Helical and leaf springs – Springs in series and parallel. **Cams:** Types of cams and followers – Cam profile. **Power Transmission:** Gears (terminology, spur, helical and bevel gears, gear trains). Belt drives (types). Chain drives. **Simple Problems.**

## ENERGY

**Sources:** Renewable and non-renewable (various types, characteristics, advantages/disadvantages). **Power Generation:** External and internal combustion engines - Hydro and nuclear power plants (layouts, element/component description, advantages, disadvantages, applications). **Simple Problems.**

## MANUFACTURING PROCESSES

**Sheet Metal Work:** Introduction – Equipments – Tools and accessories – Various processes (applications, advantages / disadvantages). **Welding:** Types – Equipments – Tools and accessories – Techniques employed (applications, advantages / disadvantages (gas and arc welding only)) – Gas cutting – Brazing and soldering. **Lathe Practice:** Types - Description of main components – Cutting tools – Work holding devices – Basic operations. **Simple Problems.** **Drilling Practice:** Introduction – Types – Description – Tools. **Simple Problems.**

## TEXT BOOKS

1. Kumar, T., Leenus Jesu Martin., and Murali, G., “*Basic Mechanical Engineering*”, Suma Publications, Chennai, 2007.
2. Prabhu, T. J., Jai Ganesh, V., Jebaraj, S., “*Basic Mechanical Engineering*”, Scitech Publications, Chennai, 2000.

## REFERENCE BOOKS

1. Hajra Choudhary, S.K. and Hajra Choudhary, A. K., “*Elements of Manufacturing Technology*”, Vols. I & II, Media Publishers, 1986.
2. Nag, P.K., “*Power Plant Engineering*”, Tata McGraw-Hill, New Delhi, 2006.
3. Palanichamy, M.S., “*Basic Civil & Mechanical Engineering*”, Tata McGraw-Hill, New Delhi 1991.
4. Nagpal G. R., “*Power Plant Engineering*”, Khanna Publisher, Delhi, 2004

		L	T	P	C
PD 0101	PERSONALITY DEVELOPMENT - I	0	0	2	0
	Prerequisite				
	Nil				

## PURPOSE

The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential

## INSTRUCTIONAL OBJECTIVES

1. To guide thought process.
2. To groom students' attitude.
3. To develop communication skill.
4. To build confidence.

## METHODOLOGY

The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation
5. Empirical Learning

Self-analysis SWOT - Time management - Creative chain story telling

Vocabulary games I – Attitude - Interpersonal skills  
 Motivation I - Vocabulary games II - Article review  
 Team building exercise - Critical Thinking - Event Management  
 Business situation - Leadership Qualities - Review

### SCHEME OF INSTRUCTION

Marks allocated for regular participation in all oral activities in class

### SCHEME OF EXAMINATION

Complete Internal evaluation on a regular Basis

		L	T	P	C
<b>GE0107</b>	<b>NSS/NCC/NSO/YOGA</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	Prerequisite				
	Nil				

### I. YOGA SYLLABUS

PRACTICE		LECTURE
I	Meditation – Agnai, Asanas, Kiriya, Bandas, Muthras	Benefits of Agnai Meditation
II	Meditation Santhi Physical Exercises (I & II)	Benefits of santhi Meditation
III	Kayakalpa Yoga Asanas, Kiriya, Bandas, Muthras	Lecture & Practice
IV	Meditation Santhi Physical Exercises III & IV	Analysis of Thought
V	Meditation Thuriyam Kayakalpa Asanas, Kiriya, Bandas, Muthras	Benefits of Thuriyam
VI	Meditation Thuriyam Kayakalpa Asanas, Kiriya, Bandas, Muthras	Attitude
VII	Meditation Thuriyam Kayakalpa Asanas, Kiriya, Bandas, Muthras	Importance of Arutkappy & Blessings
VIII	Meditation Santhi Kayakalpa Asanas, Kiriya, Bandas, Muthras	Benefits of Blessings
<b>Hours = 30</b>		

### TEXT BOOKS

1. Vedatri Maharshi, “Yoga for Modern Age”
2. Vedatri Maharshi, “Simplified Physical Exercises”

### II. NATIONAL SPORTS ORGANISATION (NSO)

Each student must select two of the following games and practice for two hours per week. An attendance of 80% is compulsory to earn the credits specified in the curriculum.

#### List of games:

1. Basket Ball
2. Football
3. Volley Ball
4. Ball Badminton
5. Cricket
6. Throwball

### III. NATIONAL CADET CORPS (NCC)

Any student enrolling as a member of National Cadet Core (NCC) will have to attend sixteen parades out of twenty parades each of four periods over a span of academic year.

Attending eight parades in first semester will qualify a student to earn the credits specified in the curriculum.

#### IV. NATIONAL SERVICE SCHEME (NSS)

A student enrolling as member of NSS will have to complete 60 hours of training / social service to be eligible to earn the credits specified in the curriculum.

		L	T	P	C
<b>GE0105</b>	<b>COMPUTER LITERACY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	Prerequisite				
	Nil				

#### PURPOSE

This Lab Course will enable the students to understand the basics of computer and to know the basics of MS-Office.

#### INSTRUCTIONAL OBJECTIVES

1. To learn the basics of computer.
2. To work on Ms-Word, Ms-Excel, Ms-Power Point and Ms-Access

#### EXPERIMENTS TO IMPLEMENT

1. Study experiment on evolution of computer programming languages.
2. Suggest some of the Network Topologies that can be incorporated in your campus. Justify your choice.
3. Experiments to demonstrate directory creation and file creation.
4. Create a document with all formatting effects.
5. Create a document with tables.
6. Create labels in MS word.
7. Create a document to send mails using mail merge option.
8. Create an Excel File to analyze the student's performance. Create a chart for the above data to depict it diagrammatically.
9. Create Excel sheet to use built-in-function.
10. Create Excel sheet to maintain employee information and use this data to send mails using mail merge.
11. Create a Power Point presentation for your personal profile with varying animation effects with timer.
12. Consider student information system which stores student personal data, mark information and non academic details.
  - \* Use MS Access to create Tables and execute SQL queries to do this following
  - \* Display all student records.
  - \* Display student details with respect to his identity.
  - \* Delete some records from the table.
  - \* Find total marks obtained by student in each list.

#### TEXT BOOK

1. "Introduction to Information Technology" ITL Education Solutions Ltd., Pearson 2<sup>nd</sup> Edition, 2006.

		L	T	P	C
<b>PH 0103</b>	<b>PHYSICS LABORATORY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	Prerequisite				
	Nil				

#### PURPOSE

The purpose of this course is to develop scientific temper and analytical capability among the engineering students.

#### INSTRUCTIONAL OBJECTIVES

At the end of the course, the student will be able to:

1. Understand scientific concepts in measurement of different physical variables
2. Develop the skill in arranging and handling different measuring instruments and
3. Get familiarized with the errors in various measurements and planning / suggesting how these contributions may be made of the same order so as to make the error in the final result small.

**LIST OF EXPERIMENTS**

1. Determination of Young's Modulus of the material – Uniform bending
2. Determination of Rigidity Modulus of the material – Torsion Pendulum
3. Determination of velocity of Ultrasonic waves in liquids
4. Determination of dispersive power of a prism using spectrometer
5. Determination of laser parameter – Divergence and wavelength for a given laser source – laser grating
6. Particle size determination using laser
7. Study of attenuation and propagation characteristics of optical fiber cable
8. Calibration of voltmeter using potentiometer.
9. Calibration of ammeter using potentiometer.
10. Construction and study of regulation properties of a given power supply using IC

**REFERENCE BOOKS**

1. Chattopadhyay, D., Rakshit, P. C. and Saha, B., “*An Advanced Course in Practical Physics*”, 2<sup>nd</sup> edition, Books & Allied Ltd., Calcutta, 1990.
2. Chauhan and Singh, “*Advanced Practical Physics*”, Revised edition, Pragati Prakashan, Meerut, 1985.
3. Thiruvadigal. J. D., Ponnusamy. S., Vasuhi. P. S. and Kumar. C, “*Hand Book of Practical Physics*”, 5<sup>th</sup> edition, Vibrant Publication, Chennai, 2007.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>CY 0103</b>	<b>CHEMISTRY LABORATORY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

**PURPOSE**

An integrated laboratory course consists of experiments from applied chemistry and is designed to illustrate the underlying principles of measurement techniques, synthesis, dynamics and chemical transformation.

**INSTRUCTIONAL OBJECTIVES**

Students should be able to understand the basic concept and its applications.

**LIST OF EXPERIMENTS**

1. Preparation of standard solutions.
2. Estimation of total hardness, permanent and temporary hardness by EDTA method.
3. Conductometric titration – determination of strength of an acid.
4. Estimation of iron by potentiometer – titration.
5. Determination of molecular weight of polymer by viscosity average – method.
6. Determination of dissolved oxygen in a water sample by Winkler's method
7. Determination of Na / K in water sample by Flame photometry.
8. Estimation of Copper in ore.
9. Estimation of nickel in steel.
10. Determination of total alkalinity and acidity of a water sample.

**REFERENCE**

1. Chemistry department manual, Edition, 2003.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0120</b>	<b>WORKSHOP PRACTICE</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

**PURPOSE**

To provide the students with hands on experience on different trades of engineering like fitting, carpentry, smithy, welding and sheet metal.

**INSTRUCTIONAL OBJECTIVES**

To familiarize with

1. The basics of tools and equipments used in fitting, carpentry, sheet metal, welding and smithy.
2. The production of simple models in the above trades.

## LIST OF EXPERIMENTS

**EMPHASIS TO BE LAID ON REAL LIFE APPLICATIONS WHEN FRAMING THE EXERCISES.**

### **FITTING**

Tools & Equipments – Practice in Filing and Drilling.  
Making Vee Joints, Square, dovetail joints, Key Making.

### **CARPENTARY**

Tools and Equipments- Planning practice. Making Half Lap, dovetail, Mortise & Tenon joints, a mini model of a single door window frame.

### **SHEET METAL**

Tools and equipments - Fabrication of a small cabinet, Rectangular Hopper, etc.

### **WELDING**

Tools and equipments - Arc welding of butt joint, Lap Joint, Tee Fillet. Demonstration of Gas welding, TIG & MIG.

### **SMITHY**

Tools and Equipments –Making simple parts like hexagonal headed bolt, chisel.

### **TEXT BOOKS**

1. Gopal, T.V., Kumar, T., and Murali, G., “*A first course on workshop practice – Theory, practice and work book*”, Suma Publications, 2005.

### **REFERENCE BOOKS**

1. Kannaiah, P. & Narayanan, K.C. “*Manual on Workshop Practice*”, Scitech Publications, Chennai, 1999.
2. Venkatachalapathy, V.S. , “*First year Engineering Workshop Practice*”, Ramalinga Publications, Madurai, 1999.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0130</b>	<b>ENGINEERING GRAPHICS</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>3</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

(Only First Angle Projection is to be followed)

### **PURPOSE**

1. To draw and interpret various projections of 1D, 2D and 3D objects.
2. To prepare and interpret the drawings of buildings.

### **INSTRUCTIONAL OBJECTIVES**

To familiarise with

1. The construction of geometrical figures
2. The projection of 1D, 2D & 3D elements
3. Sectioning of solids and development of surfaces
4. Preparation and interpretation of building drawing

### **FUNDAMENTALS OF ENGINEERING GRAPHICS**

Lettering, two dimensional geometrical constructions, conics, representation of three-dimensional objects – principles of projections – standard codes – projection of points.

### **PROJECTION OF LINES AND SOLIDS**

Projection of straight lines, projection of solids – auxiliary projections

### **SECTIONS AND DEVELOPMENTS**

Sections of solids and development of surfaces.

## PICTORIAL PROJECTIONS

Conversion of projections: Orthographic projection, isometric projection of regular solids & combination of solids.

## BUILDING DRAWING

Building Drawing – plan, elevation and section of single storied residential (or) office building with flat RCC roof and brick masonry walls having not more than 3 rooms (planning / designing is not expected in this course).

## TEXT BOOKS

1. Jeyapoovan, T., “*Engineering Drawing and Graphics using AutoCAD 2000*”, Vikas Publishing house Pvt Ltd, NewDelhi, 2005.
2. Narayanan, K.L & Kannaiah, P., “*Engineering Graphics*”, Scitech Publications, Chennai, 1999.

## REFERENCE BOOKS

1. Bhatt, N.D., “*Elementary Engineering Drawing (First Angle Projection)*”, Charotar Publishing Co., Anand, 1999.
2. Venugopal, K. “*Engineering Drawing & Graphics*”, New Age international Pvt. Ltd., 2001.
3. Natarajan, K.V. “*Engineering Drawing & Graphics*”, Private Publication, Chennai, 1990.
4. Shah, M.B. and Rana, B.C., “*Engineering Drawing*”, Pearson Education (Singapore) Pvt. Ltd., Delhi – 110 092, 2005.

## SEMESTER II

		L	T	P	C
GE 0108	VALUE EDUCATION	1	0	0	1
	Prerequisite				
	Nil				

## PURPOSE

To provide guiding principles and tools for the development of the whole person, recognizing that the individual is comprised of Physical Intellectual, Emotional and Spiritual dimensions.

## INSTRUCTIONAL OBJECTIVES

- To help individuals think about and reflect on different values.
- To deepen understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the Community and the world at large.
- To inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening them.

Value Education—Introduction – Definition of values – Why values? – Need for Inculcation of values – Object of Value Education – Sources of Values – Types

Values:

- i) Personal values
- ii) Social values
- iii) Professional values
- iv) Moral and spiritual values
- v) Behavioral (common) values

Personal values – Definition of person – Self confidence – Self discipline – Self Assessment – Self restraint – Self motivation – Determination – Ambition – Contentment – Humility and Simplicity - Sympathy and Compassion – Gratitude -Forgiveness – Honesty – Courtesy.

Social values – Definition of Society – Units of Society - Individual, family, different groups – Community – Social consciousness – Equality and Brotherhood – Dialogue – Tolerance – Sharing – Responsibility – Co-operation Freedom – Repentance and Magnanimity.



Professional values – Definition – Competence – Confidence – Devotion to duty –Efficiency – Accountability – Respect for learning /learned – Willingness to learn-Open and balanced mind – Team spirit – Professional Ethic – Willingness for Discussion – Aims – Effort – Avoidance of Procrastination and slothfulness –Alertness.

Behavioral values – Individual values and group values – Good manners at home and outside – Equality – Purity of thought, speech and action – Understanding the role of religion – Faith – Understanding the commonness of religions – respect for other faiths – unity in diversity – Living together – Tolerance – Non-violence – Truthfulness – Common aim – Unified effort towards peace – Patriotism.

#### REFERENCE BOOKS

1. Dr. S. Ignacimuthu S. J., Values for life, Better yourself Books, Bandra Mumbai-600 050 (1999).
2. Values(Collection of Essays)., Published by : Sri Ramakrishna Math., Chennai—4.,(1996)
3. Prof. R.P.Dhokalia., Eternal Human Values NCRT –Campus Sri Aurobindo Marg., New Delhi - 110 011.
4. Swami Vivekananda., Education., Sri Ramakrishna Math., Chennai-4(1957)
5. Tirukural (English Translation by Dr.G.U.Pope).
6. The Bible
7. The Kuran
8. The Bagavath Geetha

		L	T	P	C
MA 0102	MATHEMATICS - II	3	2	0	4
	Prerequisite				
	MA0101				

(Common to all Branches of Engineering except BT, BP, BI, BME, FPE, & GE)

#### PURPOSE

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

#### INSTRUCTIONAL OBJECTIVES

At the conclusion of the course, students should have understood Multiple Integrals , Laplace Transforms, Vector Calculus and Functions of a complex variable including contour integration and able to apply to all their Engineering problems.

#### MULTIPLE INTEGRALS

Double integration in Cartesian and polar coordinates – Change of order of integration – Area as a double integral – Triple integration in Cartesian coordinates.

#### LAPLACE TRANSFORMS

Transforms of simple functions – Basic operational properties – Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – periodic functions – Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients only.

#### VECTOR CALCULUS

Gradient, divergence, curl – Solenoidal and irrotational fields – Vector identities (without proof) – Directional derivatives – Line, surface and volume integrals – Statements of Green's, Gauss divergence and Stroke's theorems only – Verification and applications to cubes and parallelopipeds only.

#### ANALYTIC FUNCTIONS

Definition of Analytic Function – Cauchy Riemann equations – Properties of analytic functions - Determination of harmonic conjugate – Milne-Thomson's method – Conformal mappings:  $1/z$ ,  $az$   $az+b$  and bilinear transformation.

#### COMPLEX INTEGRATION

Line integral – Cauchy's integral theorem (without proof ) – Cauchy's integral formulae (with proof) – application of Cauchy's integral formulae – Taylor's and Laurent's expansions (statements only) – Singularities – Poles and Residues – Cauchy's residue theorem (with proof) - Evaluation of line integrals.

**TEXT BOOK**

1. Grewal B.S, Higher Engg Maths, Khanna Publications, 38<sup>th</sup> Edition.
2. Veerajan, T., Engineering Mathematics, Tata McGraw Hill Publishing Co., New Delhi,2000.
3. Dr.V.Ramamurthy & Dr. Sundarammal Kesavan, Engineering Mathematics – Vol I & II Anuradha Publications, Revised Edition 2006.

**REFERENCE BOOKS**

1. Kreyszig.E, Advanced Engineering Mathematics, 8<sup>th</sup> edition, John Wiley & Sons. Singapore,2001.
2. Kandasamy P etal. Engineering Mathematics, Vol.I (4<sup>th</sup> revised edition), S.Chand &Co., New Delhi,2000.
3. Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., Advanced Mathematics for Engineering students, Volume I (2<sup>nd</sup> edition), S.Viswanathan Printers and Publishers, 1992.
4. Venkataraman M.K., Engineering Mathematics – First Year (2<sup>nd</sup> edition), National Publishing Co., Chennai,2000.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0102</b>	<b>BIOLOGY FOR ENGINEERS</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

**PURPOSE**

To provide a basic understanding of biological mechanisms from the perspective of engineers.

**INSTRUCTIONAL OBJECTIVES**

To familiarize the students with the basic organization of organisms and subsequent building to a living being. With this knowledge, the student will be then imparted with an understanding about the machinery of the cell functions that is ultimately responsible for various daily activities. Nervous and immune systems will be taught as examples of this signaling machinery.

**FROM ATOMS TO ORGANISMS**

The Cell: the Basic Unit of Life - Molecular Components of Cells - Expression of Genetic Information - Protein Structure and Function- Cell Metabolism - Cells Maintain Their Internal Environments - Cells Respond to Their External Environments - Cells Grow and Reproduce - Cells Differentiate

**THE MOLECULAR DESIGN OF LIFE**

Biochemistry and the Genomic Revolution- . DNA Illustrates the Relation between Form and Function- Biochemical Unity Underlies Biological Diversity-. Chemical Bonds in Biochemistry -. Biochemistry and Human Biology-. Protein Synthesis Requires the Translation of Nucleotide Sequences Into Amino Acid Sequences-.2. Aminoacyl-Transfer RNA Synthetases Read the Genetic Code- A Ribosome Is a Ribonucleoprotein Particle (70S) Made of a Small (30S) and a Large (50S) Subunit-Protein Factors Play Key Roles in Protein Synthesis-. Eukaryotic Protein Synthesis Differs from Prokaryotic Protein Synthesis Primarily in Translation Initiation

**CATALYTIC STRATEGIES**

Proteases: Facilitating a Difficult Reaction-. Making a Fast Reaction Faster: Carbonic Anhydrases-. Restriction Enzymes: Performing Highly Specific DNA-Cleavage Reactions- Nucleoside Monophosphate Kinases: Catalyzing Phosphoryl Group Exchange between Nucleotides Without Promoting Hydrolysis- metabolism- anabolism and catabolism-photosynthesis and carbon fixation- biological energy production.

**MECHANOCHEMISTRY**

How Protein Motors Convert Chemical Energy into Mechanical Work- Brief Description of ATP Synthase Structure- The F1 Motor: A Power Stroke-A Pure Power Stroke- Coupling and Coordination of Motors- Measures of Efficiency- F1-Motor of ATP synthase- The Bacterial Flagellar Motor- Motor Driven by H<sub>+</sub> and Na<sub>+</sub> Ion Flux- Proton Motive Force, Sodium-motive Force, Ion Flux- Molecular Motor Directionality- Chimeric Kinesin Motors- Backwards Myosins- Chimeric Myosin Motors- Bidirectional Dyneins?

**SENSORY AND IMMUNE SYSTEMS**

General Principles of Cell Signaling-Signaling via G-Protein-linked Cell-Surface Receptors-Signaling via Enzyme-linked Cell-Surface Receptors-Target-Cell Adaptation-The Logic of Intracellular Signaling: Lessons from Computer-based "Neural Networks"-The Cellular Basis of Immunity-The Functional Properties of

Antibodies-The Fine Structure of Antibodies-The Generation of Antibody Diversity-T Cell Receptors and Subclasses-MHC Molecules and Antigen Presentation to T Cells-Cytotoxic T Cells-Helper T Cells and T Cell Activation-Selection of the T Cell Repertoire

#### TEXT BOOK

1. J.M.Berg, J.L.Tymoczko and L.Sryer. Biochemistry, W.H. Freeman Publications.
2. **STUDENT COMPANION** to accompany **Biochemistry, Fifth Edition -Richard I. Gumport**
3. **Frank H. Deis, Nancy Counts Gerber, Roger E. Koeppe, II** Molecular motors

#### REFERENCE BOOKS:

1. Alberts, 2003 Molecular Biology of the cell
2. Lodish, 2004 Molecular cell biology

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>GE 0104</b>	<b>PRINCIPLES OF ENVIRONMENTAL SCIENCE</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
	Prerequisite				
	Nil				

#### PURPOSE

The course provides the comprehensive knowledge in environmental science, environmental issues and the management.

#### INSTRUCTIONAL OBJECTIVES

1. The importance of environmental education, ecosystem and ethics.
2. Knowledge with respect to biodiversity and its conservation.
3. To create awareness on the various environmental pollution aspects and issues.
4. To educate the ways and means to protect the environment.
5. Important environmental issues and protection

#### ENVIRONMENT AND ECOSYSTEMS

Environmental education: definition - scope - objectives and importance. Concept of an ecosystem – types (terrestrial and aquatic ecosystems) – structure and function – ecological succession - food chains, food webs and ecological pyramids

#### BIODIVERSITY

Introduction: definition - genetic, species and ecosystem diversity - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife - endangered and endemic species of India, Conservation of biodiversity: in-situ and ex-situ conservations.

#### POLLUTION AND WASTE MANAGEMENT

Air and water pollution – classification of pollutants and their effects – control measures of air pollution. Waste water treatment (general) – primary, secondary & tertiary stages. Solid waste management: causes - effects of municipal waste, hazardous waste, bio medical waste - process of waste management.

#### CURRENT ENVIRONMENTAL ISSUES

Environmental ethics -issues and possible solutions- population explosion, climatic change, ozone layer depletion, global warming, acid rain and green house effect. Sustainable development: definition, objectives and environmental dimensions of sustainable development- environmental audit for sustainable development.

#### ENVIRONMENTAL PROTECTION

National and international concern for environment: Important environmental protection acts in India – water, air (prevention and control of pollution) act, wild life conservation and forest act – functions of central and state pollution control boards - international effort – key initiatives of Rio declaration, Vienna convention, Kyoto protocol and Johannesburg summit.

#### TEXT BOOKS

1. Sharma.B.K. and Kaur, “Environmental Chemistry”“ Goel Publishing House, Meerut, 1994.

2. De.A.K., "Environmental Chemistry", New Age International (p) Lt., , New Delhi, 1996.
3. Kurian Joseph & R. Nagendran, "Essential of Environmental Studies"" Pearson Education, 2004.

#### REFERENCE BOOKS

1. Dara S.S., A Text Book of Environmental Chemistry and pollution control, S.Chand & Company Ltd., New Delhi, 2004.
2. Jeyalakshmi.R, Principles of Environmental Science, 1<sup>st</sup> Edition, Devi Publications, Chennai 2006.
3. Kamaraj.P & Arthanareeswari.M, Environmental Science – Challenges and Changes, 1<sup>st</sup> Edition, Sudhandhira Publications, 2007.
4. Arivalagan.K, Ramar.P & Kamatchi.P, Principles of Environmental Science, 1<sup>st</sup> Edition, Suji Publications, 2007.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH 0102</b>	<b>MATERIALS SCIENCE</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>
	Prerequisite				
	Nil				

#### PURPOSE

The purpose of this course is to develop comprehension of the rapidly changing technological scenario and the requisite expertise for appropriate selection of materials for specific engineering applications.

#### INSTRUCTIONAL OBJECTIVES

At the end of the course, the student will be able to:

1. Understand electrical properties of materials,
2. Understand the properties and applications of semi conducting materials,
3. Understand general properties and applications of magnetic and dielectric materials,
4. Understand the behaviour of materials on exposure to light,
5. Understand general properties and application of modern engineering and bio materials, and
6. Get familiarized with the concepts of Nano Science and Technology.

#### ELECTRONIC AND PHOTONIC MATERIALS

**Electronic materials:** Importance of Classical and Quantum free electron theory of metals – Fermi energy and Fermi Dirac distribution function – Variation of Fermi level with temperature in intrinsic and extrinsic semiconductors – Hall effect – Dilute Magnetic Semiconductors (DMS) and their applications – High temperature Superconductivity. **Photonic materials:** LED and LCD materials – Photo conducting materials – Nonlinear optical materials (elementary ideas) and their applications.

#### MAGNETIC, DIELECTRIC AND MODERN ENGINEERING MATERIALS

**Magnetic materials:** Ferrites and garnets – Magnetic bubbles and their applications – Giant Magneto Resistance (GMR) – Colossal Magneto Resistance (CMR). **Dielectric materials:** Various polarization mechanisms in dielectrics (elementary ideas) and their frequency and temperature dependence – Dielectric loss – Piezo electric and ferro electric materials and their applications. **Modern engineering materials:** Shape memory alloys – Metallic glasses – Advanced ceramics and composites.

#### BIO MATERIALS

Classification of biomaterials – Comparison of properties of some common biomaterials – Effects of physiological fluid on the properties of biomaterials – Biological responses (extra and intra vascular system) – Metallic, Ceramic and Polymeric implant materials – Introduction to bio sensors and tissue engineering.

#### NANO MATERIALS AND NANOTECHNOLOGY

Basic concepts of Nano science and technology – Quantum wire – Quantum well – Quantum dot – Properties and technological advantages of Nano materials – Carbon Nanotubes and applications – Material processing by Sol – Gel method, Chemical Vapour deposition and Physical Vapour deposition – Microwave Synthesis of materials – Principles of SEM, TEM and AFM .

#### MECHANICAL PROPERTIES OF MATERIALS

Stress Strain diagram for different engineering materials – Engineering and true stress strain diagram – Ductile and brittle material – Tensile strength – Hardness – Impact strength – Fatigue – Creep – Fracture (Types and Ductile to brittle transition) – Factors affecting mechanical properties.

1. Band gap determination using Post office box.
2. Dielectric constant measurement.
3. Photoconductivity measurement.
4. Resistivity determination for a semiconductor wafer using Four probe method.
5. Determination of Hall coefficient and carrier type for a semiconductor material.
6. To trace the hysteresis loop for a magnetic material.
7. Magnetic susceptibility – Quincke's method.
8. Determination of thermal conductivity – Lee's Disc method
9. Visit to Nano Technology Laboratory (optional)

#### TEXT BOOKS

1. S.O. Kasap, *Principles of Electronic Materials and Devices*, Tata McGraw Hill Edition, New Delhi, 2002.
2. Van Vlack, L.H., *Material Science for Engineers*, 6<sup>th</sup> edition, Addison Wesley, 1985.
3. Thiruvadigal, J. D., Ponnusamy, S. and Vasuhi.P. S., *Materials Science*, 5<sup>th</sup> edition, Vibrant Publications, Chennai, 2007.

#### REFERENCE BOOKS

1. Rolf E. Hummel, *Electronic Properties of materials*, Narosa Publishing House, New Delhi, 1994.
2. Raghavan.V., *Materials Science & Engineering – A First Course*, 5<sup>th</sup> edition, Prentice Hall of India, New Delhi, 2005.
3. Khanna. O. P., *A Text Book of Material Science & Metallurgy*, Revised edition, Dhanpat Rai Publications, New Delhi, 2006.
4. Sujata V. Bhat, *Biomaterials*, 2<sup>nd</sup> edition, Narosa Publishing House, New Delhi, 2006.
5. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, *Nano Technology – Basic Science and Emerging Technologies*, 1<sup>st</sup> edition, Overseas Press, New Delhi, 2005.

		L	T	P	C
ME 0102	ENGINEERING MECHANICS	3	2	0	4
	Prerequisite				
	Nil				

(Vectorial approach may be preferred)

#### PURPOSE

To develop in the engineering student the ability to analyze any problem in a simple and logical manner and to apply it to solve a few basic problems in engineering mechanics.

#### INSTRUCTIONAL OBJECTIVES

At the end of this course the student should be able to understand

1. The vectorial and scalar representation of forces and moments
2. Static equilibrium of particles and rigid bodies
3. Principle of work and energy
4. Analysis of trusses, friction and their application
5. Dynamic equilibrium of particles and rigid bodies

#### STATICS OF PARTICLES

**Equilibrium of Particle:** Introduction – Laws of mechanics – Forces on particles – Concurrent forces in a plane – Coplanar forces – Resolution of forces – Resultant of several concurrent forces – Free body diagram – Equilibrium of particles in space. **Equilibrium of rigid bodies:** Principles of transmissibility – Moment of a force – Varignon's theorem – Equivalent system of forces – Reduction of system of forces into single force and couple-Types of loads-Types of supports and their reactions – Equilibrium of rigid bodies in two dimensions.

#### ANALYSIS OF TRUSSES AND FRICTION

**Trusses:** Plane Trusses – Simple Trusses – Analysis of Trusses – Method of joints, Method of sections.

**Friction:** Laws of Friction – Angle of Friction – Inclined plane – Wedges – Rolling friction – Belt Friction – Thrust and Journal bearings.

## PROPERTIES OF SURFACES AND VOLUMES

**Centre of Gravity:** Centroids of areas and volumes – Determination of centroids by integration – Theorem of Pappus-Guldinus. **Moment of Inertia:** Determination of moment of inertia of area by integration – Radius of gyration – Parallel and perpendicular axis theorems – Polar moment of inertia – Mass moment of inertia.

## DYNAMICS OF PARTICLES

Rectilinear motion – Curvilinear motion – Motion of projectile – Relative motion – Newton's law-Principle of work and energy – Principle of impulse and momentum – Impulsive motion – Impact of elastic bodies – D'Alembert's principle.

## DYNAMICS OF RIGID BODIES

Kinematics of rigid bodies – Translation and rotation of rigid bodies – Fixed axis rotation – General plane motion –Relative velocity in plane motion – Instantaneous center of rotation in plane motion – Principle of work and energy for a rigid body – Principle of impulse and momentum.

## TEXT BOOKS

1. Beer, F. P., and Johnston, E. R., *Vector Mechanics for Engineers – Dynamics and Statics*, Tata McGraw-Hill, New Delhi, 2001.
2. Palanichamy, M. S., and Nagan, S., *Engineering Mechanics (Statics and Dynamics)*, Tata McGraw Hill, New Delhi 2001.
3. Kumar, K. L., *Engineering Mechanics*, Tata McGraw- Hill, New Delhi, 1998.

## REFERENCE BOOKS

1. Timoshenko, and Young, *Engineering Mechanics*, Tata McGraw Hill Book Company, New Delhi, 1956.
2. McLean, and Nelson, *Engineering Mechanics (Statics and Dynamics)*, 3<sup>rd</sup> Edition, Schaum Series, 1980.
3. Rajasekaran, S. and Sankarasubramanian, G., *Engineering Mechanics*, Vikas Publishing House Pvt Ltd, 2006.
4. Shames, I. H., and Krishna Mohana Rao, G., *Engineering Mechanics (Statics and Dynamics)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 2006.

		L	T	P	C
GE 0106	BASIC ENGINEERING – II	4	0	0	4
	Prerequisite				
	Nil				

## PURPOSE

This course provides comprehensive idea about circuit analysis, working principles of machines and common measuring instruments. It also provides fundamentals of electronic devices, transducers and integrated circuits.

## INSTRUCTIONAL OBJECTIVES

1. At the end of the course students will be able
2. To understand the basic concepts of magnetic, AC & DC circuits.
3. To explain the working principle, construction, applications of DC & AC machines & measuring instruments.
4. To gain knowledge about the fundamentals of electric components, devices, transducers & integrated circuits.

## PART A ELECTRICAL ENGINEERING

### ELECTRICAL MACHINES

Definition of mmf, flux and reluctance, leakage flux, fringing, magnetic materials and B-H relationship. Problems involving simple magnetic circuits. Faraday's laws, induced emfs and inductances, brief idea on Hysteresis and eddy currents. Working principle, construction and applications of DC machines and AC machines (1-phase transformers, 3-phase induction motors, single phase induction motors – split phase, capacitor start and capacitor start & run motors).

### AC & DC CIRCUITS

Circuit parameters, Ohms law, Kirchhoff's law. Average and RMS values, concept of phasor representation. RLC series circuits and series resonance, RLC parallel circuits (includes simple problems in DC & AC circuits) Introduction to three phase systems – types of connections, relationship between line and phase values. (qualitative treatment only)

## WIRING & LIGHTING

Types of wiring, wiring accessories, staircase & corridor wiring, Working and characteristics of incandescent, fluorescent, SV & MV lamps. Basic principles of earthing, simple layout of generation, transmission & distribution of power.

## TEXT BOOKS

1. Kothari D P and Nagrath I J , Basic Electrical Engineering , Tata McGraw Hill,1991
2. Mehta V K ,Principles of Electronics S Chand & Co,1980

## REFERENCE BOOKS

1. Kothari D P and Nagrath I J ,Basic Electrical Engineering , Tata McGraw Hill,1991
2. Mithal G K , Electronic Devices and Circuits, Khanna Publications,1997

## PART B ELECTRONICS ENGINEERING

### ELECTRONIC COMPONENTS AND DEVICES

Passive components – Resistors, Inductors and Capacitors and their types.

**Semiconductor:** Energy band diagram, Intrinsic and Extrinsic semiconductors, PN junction diodes and Zener diodes – characteristics.

**Transistors:** PNP and NPN transistors – theory of operation – Transistor configurations – characteristics – comparison.

**Special semiconductor devices :** FET – SCR – LED – V I characteristics – applications.

**Rectifiers:** Half wave and full wave rectifier – capacitive filter – wave forms – ripple factor – regulation characteristics.

### TRANSDUCERS AND MEASURING INSTRUMENTS

**Transducers:** General features and classification of transducers, Resistive Transducers – Potentiometer, Unbonded strain gauge-Bonded strain gauge-Load cell, Inductive transducers – Differential output transducers – LVDT, Flow transducers, Temperature Transducers – Thermistors, Thermocouple and pyrometers.

**Measuring Instruments:** Basic principles and classification of instruments, Moving coil and moving iron instruments, CRO – Principle of operation.

### DIGITAL ELECTRONICS & LINEAR ICs

**Digital Fundamentals:** Number systems – Boolean Theorems – DeMorgan's Theorem - Logic gates – Implementation of Boolean Expression using Gates.

**Integrated Circuits:** IC fabrication – Monolithic Technique, Function of Operational Amplifier.

## TEXT BOOKS

1. Muthusubramanian.R, Salivahanan.S, Muraleedharan.K.A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw - Hill ,1999.
2. Metha V.K, “Principles of Electronics “,S. Chand & Co.,1980.
3. Kalsi H S, Electronics Instrumentation”, ISTE publication,1995

## REFERENCE BOOKS

1. Kothari D. P and Nagrath IJ, “Basic Electrical Engineering”, Tata McGraw- Hill, 1991.
2. Thomas L.Floyd “Electronic devices”, Addison Wesley Longman (Singapore) Pvt . Ltd., 5<sup>th</sup> Edition.

		L	T	P	C
PD 0102	PERSONALITY DEVELOPMENT - II	0	0	2	0
	Prerequisite				
	Nil				

## PURPOSE

The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential

**INSTRUCTIONAL OBJECTIVES**

1. To guide thought process.
2. To groom students' attitude.
3. To develop communication skill.
4. To build confidence.

**METHODOLOGY**

The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Puzzles I - Poster design/Caption/Slogan writing (Social issues) - Bone of contention I – debate

Bone of contention II - Puzzle II - Survey and Reporting (favorite channel, music, food)

Interpretation of Visuals of I & II - Vocabulary games III

Book Review - Quiz I - Presentation Skills I

Presentation Skills II - Analytical Thinking - Review

**EVALUATION**

1. Activities assessed by both group and individual participation
2. Continuous assessment based on daily participation

**SCHEME OF INSTRUCTION**

Marks allocated for regular participation in all oral activities in class

**SCHEME OF EXAMINATION**

Complete Internal evaluation on a regular Basis

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0122</b>	<b>COMPUTER PROGRAMMING PRACTICE</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>
	Prerequisite				
	Nil				

**PURPOSE**

To provide hands-on training to the students in C – programming language and drafting exercises in Mechanical Engineering

**INSTRUCTIONAL OBJECTIVES**

To familiarise the students with C and C++ Programming.

**LIST OF EXPERIMENTS****C AND C++ PROGRAMMING**

1. Arrays, string manipulation
2. Matrix Manipulation – transpose, inverse, triangularisation
3. Functions and subroutines
4. Structures, user defined data type, enumeration
5. Records
6. File handling – opening, closing, creating, appending of unformatted data files – mark sheet processing
7. Sorting and searching



## REFERENCE BOOKS

1. Balaguruswamy, E., *Programming in ANSI C*, Tata McGraw-Hill, New Delhi, 2004.
2. Goldfried, B. S., *Programming with C - Schaum outline series*, Tata McGraw-Hill Edition, 1998.
3. Laboratory Manual.

		L	T	P	C
ME0130	ENGINEERING GRAPHICS	1	0	4	3
	Prerequisite				
	Nil				

(Only First Angle Projection is to be followed)

## PURPOSE

1. To draw and interpret various projections of 1D, 2D and 3D objects.
2. To prepare and interpret the drawings of buildings.

## INSTRUCTIONAL OBJECTIVES

To familiarise with

1. The construction of geometrical figures
2. The projection of 1D, 2D and 3D elements
3. Sectioning of solids and development of surfaces
4. Preparation and interpretation of building drawing

## FUNDAMENTALS OF ENGINEERING GRAPHICS

Lettering – Two dimensional geometrical constructions – Conics – Representation of three-dimensional objects – Principles of projections – Standard codes – Projection of points.

## PROJECTION OF LINES AND SOLIDS

Projection of straight lines – Projection of solids – Auxiliary projections.

## SECTIONS AND DEVELOPMENTS

Sections of solids and development of surfaces.

## PICTORIAL PROJECTIONS

Conversion of Projections: Orthographic projection – Isometric projection of regular solids and combination of solids.

## BUILDING DRAWING

Plan, elevation and section of single storied residential (or) office building with flat RCC roof and brick masonry walls having not more than 3 rooms (planning / designing is not expected in this course).

## TEXT BOOKS

1. Venugopal, K. and Prabhu Raja, V., *Engineering Graphics*, Eighth Edition (Revised), New Age International Publishers, Chennai, 2007.
2. Natarajan, K.V., *A Text Book of Engineering Graphics*, 21<sup>st</sup> Edition, Dhanalakshmi Publishers, Chennai, 2007
3. Jeyapoovan, T., *Engineering Drawing and Graphics using AutoCAD 2000*, Vikas Publishing House Pvt. Ltd., New Delhi, 2005.

## REFERENCE BOOKS

1. Bhatt, N.D., *Elementary Engineering Drawing (First Angle Projection)*, Charotar Publishing Co., Anand, 1999.
2. Narayanan, K. L. and Kanniah, P., *Engineering Graphics*, Scitech Publications, Chennai, 1999.
3. Shah, M. B. and Rana, B. C., *Engineering Drawing*, Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2005.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0120</b>	<b>WORKSHOP PRACTICE</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

#### **PURPOSE**

To provide the students with, hands on experience on different trades of engineering like fitting, carpentry, smithy, welding and sheet metal.

#### **INSTRUCTIONAL OBJECTIVES**

To familiarize with

The basics of tools and equipments used in fitting, carpentry, sheet metal, welding and smithy.

The production of simple models in the above trades.

#### **LIST OF EXPERIMENTS**

#### **EMPHASIS TO BE LAID ON REAL LIFE APPLICATIONS WHEN FRAMING THE EXERCISES.**

#### **FITTING**

Tools & Equipments – Practice in Filing and Drilling.

Making Vee Joints, Square, dovetail joints, Key Making.

#### **CARPENTRY**

Tools and Equipments- Planning practice. Making Half Lap, dovetail, Mortise & Tenon joints, a mini model of a single door window frame.

#### **SHEET METAL**

Tools and equipments - Fabrication of a small cabinet, Rectangular Hopper, etc.

#### **WELDING**

Tools and equipments - Arc welding of butt joint, Lap Joint, Tee Fillet. Demonstration of Gas welding, TIG & MIG.

#### **SMITHY**

Tools and Equipments –Making simple parts like hexagonal headed bolt, chisel.

#### **TEXT BOOKS**

1. Gopal, T.V., Kumar, T., and Murali, G., “A first course on workshop practice – Theory, practice and work book”, Suma Publications, 2005.

#### **REFERENCE BOOKS**

1. Kannaiah, P. & Narayanan, K.C. “Manual on Workshop Practice”, Scitech Publications, Chennai, 1999.
2. Venkatachalapathy, V.S. “First year Engineering Workshop Practice”, Ramalinga Publications, Madurai, 1999.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0124</b>	<b>ACTIVE LEARNING LABORATORY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

#### **PURPOSE**

To make the students to understand some basic concepts using learning through discovery method.

#### **INSTRUCTIONAL OBJECTIVES**

To familiarise the students with basic concepts, theorems, etc.

#### **LIST OF EXPERIMENTS**

1. Lami’s theorem.
2. Four bar mechanism.
3. Friction.

4. Fourier law of heat conduction.
5. Pneumatics circuits. and others.

#### REFERENCE BOOKS

1. Laboratory Manual.

#### SEMESTER III

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE0201</b>	<b>GERMAN LANGUAGE PHASE I</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

#### PURPOSE

Enabling the Engineering Students to one more Foreign Language, especially German, which is scientific and technical language. This may be useful in the field of employment opportunities as well as helping them to develop projects on browsing German websites.

#### INSTRUCTIONAL OBJECTIVES

Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

#### UNIT 1 INTRODUCTION

German Language, Alphabets and Pronunciation.

#### THEMEN

Name, Land, Leute, Beruf, Familie geschwister, Einkaufen, Reisen, Zahlen, Haus, Freunden, Essen and Stadium, Fest, Zeit.

#### UNIT 2 LISTENING

Listening to the cassette and pay special attention to the meaning and sounds. Listening Comprehension – Announcements / Airport / Station / General.

#### UNIT 3 READING

Listening to the cassette and reading it allowed.

READING COMPRENSION BASICS / STATION / NEWS / NOTICE BOARDS.

#### GLOSSARY

Technical Words Lesson (1-5)

#### TEXT BOOK WITH CASSETTES

1. Grundkurs Deutsch
2. Momentmal (Max Mueller Bhavan – Goethe Institute, Germany).

#### SCHEME OF EVALUATION

Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE0203</b>	<b>JAPANESE LANGUAGE PHASE I</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

#### PURPOSE

1. In view of globalization, learning Foreign Language by Engineering graduates enhances their employment opportunities.
2. Get awareness of understanding of International culture.
3. Widening the Linguistic Skills of the Students.

### INSTRUCTIONAL OBJECTIVES

To learn the scripts of Japanese Languages namely Hiragana, Katakana and Kanji, Vocabularies etc. To learn basic grammar and acquire basic communication skills. To understand Japanese culture.

Alphabets (Hiragana ), Self Introduction, Greetings, Classroom expressions, Numbers, Conversation.

Alphabets Hiragana (continued), Vocabularies.

Counters .Time expression. Conversation

Katakana and related vocabulary.

Kanjis –introduction. conversation.

Lesson-1 Watashiwa Nihonjin desu. Grammar, Marume & Sentence pattern. Marume. Conversation.

### TEXT BOOKS

1. Nihongo Shoho I main Text sold in India by the Japanese Language Teachers Association Pune.
2. Hiragana and Katakana Work Book published by AOTS Japan
3. Grammar and Kotoba ( Work Book )
4. Japanese for Dummies.(Conversation) CD.

### SCHEME OF EVALUATION

Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE0205</b>	<b>FRENCH LANGUAGE PHASE I</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

### PURPOSE

1. As language skills are as valuable as technical skills a knowledge of French enables the engineering graduates in career orientation.
2. As a second international global Lang after English there is a wider choice of job opportunities in the inter national employment market and also multinationals in India and an understanding of French culture thro language.

### INSTRUCTIONAL OBJECTIVE

Characterised by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

### INTRODUCTION AND PRONUNCIATION

Introduction of the French Language, Alphabets and Pronunciation, Greetings (Wishing, Thanking and Bidding good bye), Introducing oneself & someone Presenter quelqu'un et se presenter - conversational French sentences based on the topics discussed above.

### VOCABULARY

Numbers and Dates, Days, Months and Seasons, Time, Nouns, Professions and Nationalities. C;onversational sentences on weather, time, and professions.

### GRAMMAR

Basic Verbs (Avoir, Etre, Aller, Faire) – Conjugation – Present tense, Affirmative, Negative, Interrogative, Adjectives (Qualitative), Subject Pronouns and Disjunctive Pronouns.

### CONVERSATION AND LISTENING

Conversational sentences on physical description and expressions with verbs like avoir, etre and faire

### GRAMMAR

Prepositions ( a, de,dans, en, sur,sous, pour....),Contracted Articles, Question Tag (Qui, Quel, Ou, .....etc)

### TEXT BOOKS

1. Panorama – Goyal Publishers
2. Apprenons le Français I, Sarawathy publication.

### SCHEME OF EVALUATION

Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks

		L	T	P	C
MA0201	MATHEMATICS – III	3	2	0	4
	Prerequisite				
MA0101&MA0102	(Mathematics I & II)				

### PURPOSE

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

### INSTRUCTIONAL OBJECTIVES

At the end of the course, student should be able,

1. To grasp the concept of Fourier Series and its applications
2. To solve partial differential equations
3. To be familiar with boundary value problems
4. To learn more about Fourier Transforms
5. To understand thoroughly fundamentals of statistics

### FOURIER SERIES

Dirichlet's conditions – General Fourier series – Half range sine and cosine series–Parseval's identity – Harmonic analysis.

### PARTIAL DIFFERENTIAL EQUATIONS

Formation – Solution of standard types of first order equations – Lagrange's equation – Linear Homogeneous partial differential equations of second and higher order with constant coefficients

### BOUNDARY VALUE PROBLEMS

Classification of second order linear partial differential equations – Solutions of one-dimensional wave equation – one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates

### FOURIER TRANSFORMS

Statement of Fourier integral theorem – Fourier transform pairs – Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

### STATISTICS

Review of measures of central tendency – measures of dispersion (no questions should be asked) – Moments – Skewness and kurtosis based on moments – Linear correlation and regression – Tests based on normal and t distribution for means and difference of means -  $\chi^2$  test for Goodness of fit.

### TEXT BOOKS

1. Grewal, B, S., *Higher Engineering Mathematics*, 36<sup>th</sup> edition, Khanna Publishers, New Delhi, 2002. (Unit I – Chapter 10 section 10.2. – 10.7, 10.9, 10.11, Unit II – Chapter 17 Section 17.2, 17.5, 17.6, 17.8 – 17.10, Unit III – Chapter 18 Section 18.4(2), 18.5(2), 18.7, Chapter 28 Section 28.2, Unit IV – Chapter 22 Section 22.3 – 22.7, Unit V – Chapter 23 section 23.5 – 23.11, 23.34, 23.35, 23.36, 23.37.

### REFERENCE BOOKS

1. Kreyszig, E., *Advanced Engineering Mathematics*, 8<sup>th</sup> edition, John Wiley & Sons, Singapore, 2000.
2. Miller, I.R. and Freund, J.E., *Probability and Statistics for Engineers*, Prentice Hall, 1995.
3. Kandasamy, P., et al., *Engineering Mathematics, Vol. II & Vol. III* (4<sup>th</sup> revised edition), S.Chand & Co., New Delhi, 2000.
4. Narayanan, S., Manickavachagom Pillay, T., and Ramanaiah, G., *Advanced Mathematics for Engineering students*, Volume II & III (2<sup>nd</sup> edition), S.Viswanathan Printers and Publishers, 1992.
5. Venkataraman, M.K., *Engineering Mathematics – Vol.III – A & B (13th edition)*, National Publishing Co., Chennai, 1998.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0201</b>	<b>THERMODYNAMICS</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

(Use of approved Steam tables are permitted in the University Examinations)

### PURPOSE

This course provides the basic knowledge about thermodynamic laws and relations, and their application to various processes.

### INSTRUCTIONAL OBJECTIVES

Expected to

1. Understand the thermodynamic laws and their applications
2. Know the concept of entropy and availability
3. Know the thermodynamic relations
4. Have clear idea about the properties of steam and the use of steam tables and Mollier chart.

### BASIC CONCEPTS OF THERMODYNAMICS

6

Macroscopic vs Microscopic aspects – Thermodynamic system and surrounding – Forms of energy– Properties of a system – State and equilibrium– Quasi static process– Zeroth law of Thermodynamics– Heat – Work – First law of Thermodynamics – Limitations – Application of First law to non– flow system– Thermodynamic analysis of control volume– Steady flow energy equation– Applications.

### SECOND LAW OF THERMODYNAMICS

Kelvin-Planck statement – Clausius statement – Carnot cycle – Cyclic Heat engine – Heat Reservoirs – Refrigerator and Heat Pump – Equivalence of Kelvin-Planck and Clausius statements – Reversibility and Irreversibility.

### ENTROPY AND AVAILABILITY

Clausius theorem – Clausius inequality – Entropy principle – Property diagrams involving entropy – Entropy change of Ideal gases – Entropy generation in a closed system – Entropy generation in an open system – Third law of Thermodynamics – Introduction to availability in non-flow and flow Process.

### THERMODYNAMIC RELATIONS

Maxwell's equations – Clapeyron equation – General relations for  $dh, du, ds, C_p$  and  $C_v$  – Joule Thomson coefficient. Gas Mixtures – Dalton's law of partial pressures – P-v-T behaviour of gas mixtures– Property calculations.

### PROPERTIES OF STEAM

Steam formation–Temperature Entropy diagram–Mollier diagram–Specific Properties of Steam–Use of steam tables & Mollier chart–Methods of Heating & Expanding the steam–Constant Volume Heating– Constant Pressure Expansion– Isothermal Expansion–Hyperbolic Expansion–Isentropic Expansion–Polytropic Expansion–Throttling process–Dryness fraction measurement.

### TEXT BOOKS

1. Nag, P. K, *Engineering Thermodynamics*, 6<sup>th</sup> Edition, Tata McGraw Hill, New Delhi, 1995.
2. Yunus, N. J., Cengel, A., and Michael Boles, A., *Thermodynamics– An Engineering Approach*, 2nd Edition, McGraw Hill India, 1994.

### REFERENCE BOOKS

1. Michael Moran, J., and Howard Shapiro, N., *Fundamentals of Engineering Thermodynamics*, 4<sup>th</sup> Edition, John Wiley & Sons, New York, 2000.
2. Rayner Joel, *Basic Engineering Thermodynamics*, 5<sup>th</sup> Edition, Addison Wesley, New York, 1996.
3. Holman, J. P., *Thermodynamics*, 4<sup>th</sup> Edition Tata McGraw Hill, New Delhi, 1998.
4. Kothandaraman, C. P., and Domkundwar, S., *A Course in Thermal Engineering*, 5<sup>th</sup> Edition, Dhanpat Rai & Sons, New Delhi, 1998.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>IC0211</b>	<b>ELECTRONICS AND INSTRUMENTATION</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

### **PURPOSE**

The aim of this course is to familiarize the student with the principle of operation, capabilities and limitation of Electronics and instrumentation so that he will be able to use this knowledge effectively.

### **INSTRUTIONAL OBJECTIVES**

1. To study the basics of Electronics
2. To study the Characteristics of Semiconductor action and Transistor.
3. To study the application of Semiconductor Devices like UJT, MOSFET, SCR, UJT.
4. To study the Basic of Measurement
5. To study the use of Primary sensing element and Signal Conditioning Unit.

### **SEMICONDUCTOR DIODE**

Semiconductor diode – Crystal diode as a rectifier– Equivalent circuit of a Crystal Diode– Half Wave Rectifier– Efficiency of Half Wave Rectifier– Full wave Rectifier– Center tap Full Wave Rectifier– Full Wave Bridge Rectifier Efficiency of Full Wave Rectifier– Zener Diode– Equivalent Circuit of Zener Diode– Zener Diode as Voltage Stabilizer.

### **TRANSISTOR & ITS BIASING**

Transistor Symbols – Transistor as an Amplifier– Connections– CB, CE,&CC– Characteristics– Comparison of Transistor Connection. Transistor as an Amplifier in CE arrangement– Transistors Load Line analysis, Operating Point– CE Circuit – Performance of Transistor Amplifier – Cut Off and Saturation points – Transistor biasing: Methods of transistor Biasing– Base resistor method– Biasing with feedback resistor– Voltage divider bias method .

### **FET, SCR & UJT**

Types of Field Effect Transistor – JFET – Working Principles of JFET– JFET as an Amplifier and its Output Characteristics –JFET Applications– MOSFET Working Principles, SCR – Equivalent Circuit and V-I Characteristics. SCR as a Half wave and full wave rectifier– Application of SCR – Triac and Diac characteristics and its applications. UJT– Equivalent Circuit of a UJT and its Characteristics.

### **MEASUREMENT SYSTEM**

Measurements and its Significance, Methods of Measurements, Classification of Instruments and application, Elements of a Generalized Measurement System, Static and Dynamic Characteristics of an Instruments, Errors in Measurement Systems– Units, System, Dimension and standards.

### **PRIMARY SENSING ELEMENTS AND SIGNAL CONDITIONING**

Introduction– Transducers– Advantage of Electric Transducers, Classification Based upon Principle of Transduction, Primary and Secondary transducer, Passive and Active transducers, Analog and Digital transducers, Transducers and inverse transducers and examples for each. Characteristics and Choice of transducers, Input , Transfer and output Characteristics and its application. Operational Amplifier, Characteristics of Operational Amplifier, Attenuator, Amplitude Modulation and Demodulation, Basic Filters, A/D Converters. Simple Types

### **TEXT BOOKS**

1. Sawhney, A. K., *A Course in Electrical and Electronic Measurement and Instrumentation*, Dhanpat Rai & Sons, New Delhi, 1999.
2. V.K, Mehta., and Rohit Metha, *Principles of Electronics*, S.chand & Company Ltd., First Edition, 1980.
3. Millman, and Halkias, *Electronic devices and Circuits*, Tata McGraw Hill International Edition, 1994.
4. Mithal, G. K., *Electronic Devices and Circuits*, Khanna Publishers, New Delhi, 1999.

### **REFERENCE BOOKS**

- 1 Salivahanan, S., Sureshkumar, N., and Vallavaraj, A., *Electronic Devices and Circuits*, Tata McGraw-Hill, New Delhi, 1998.
- 2 Sze, S. M., *Semiconductor Devices – Physics and Technology*, 2<sup>nd</sup> Edition, John Wiley & Sons, New York, 2002.
- 3 Ben G. Streetman and Sanjay Banerjee, *Solid State Electronic Devices*, Pearson Education, 2000.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0203</b>	<b>MANUFACTURING TECHNOLOGY</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

### **PURPOSE**

To make the students aware of different manufacturing processes like metal forming, casting, metal cutting processes, gear manufacturing processes.

### **INSTRUCTIONAL OBJECTIVES**

1. Study the various ways of working of metals
2. Concept of casting Technology
3. Concept of Machining with lathes and automats
4. Study of Milling machine and Gear manufacturing process
5. Various Surface finishing and Surface hardening processes

### **CASTING AND WELDING**

Introduction to casting, Patterns, Types, Pattern materials, Allowances – Moulding – types– Moulding sand, Gating and Riser, Cores & Core making. Special casting processes– Shell, Investment, Die casting, Centrifugal Casting.

Special welding processes– Laser, Electron Beam, Ultrasonic, Electro slag, Friction welding, electrical resistance welding.

### **MECHANICAL WORKING OF METALS**

Hot and Cold Working: Rolling, Forging, Wire Drawing, Extrusion– types– Forward, backward and tube extrusion.

Sheet Metal Operations: Blanking– blank size calculation, draw ratio, drawing force, Piercing, Punching, Trimming, Stretch forming, Shearing, Bending– simple problems– Bending force calculation, Tube forming – Embossing and coining, Types of dies: Progressive, compound and combination dies.

### **THEORY OF METAL CUTTING**

Orthogonal and oblique cutting– Classification of cutting tools: single, multipoint – Tool signature for single point cutting tool – Mechanics of orthogonal cutting – Shear angle and its significance – Chip formation– Cutting tool materials– Tool wear and tool life – Machinability – Cutting Fluids– Simple problems.

### **GEAR MANUFACTURING AND SURFACE FINISHING PROCESS**

Gear manufacturing processes: Extrusion, Stamping, and Powder Metallurgy. Gear Machining: Forming. Gear generating processes– Gear shaping, Gear hobbing.

Grinding process, various types of grinding machine, Grinding Wheel– types– Selection of Cutting speed and work speed, dressing and truing. Fine Finishing– Lapping, Buffing, Honing, and Super finishing.

### **MACHINE TOOLS**

Milling Machine – specification, Types, Types of cutters, operations, Indexing methods– simple problems. Shaping, Planing and Slotting Machine– description, Operations, Work and tool holding Devices. Boring machine– Specification, operations, Jig boring machine. Broaching machine– operations, Specification, Types, Tool nomenclature.

### **TEXT BOOKS**

1. Sharma, P.C., *A textbook of Production Technology – Vol I and II*, S. Chand & Company Ltd., New Delhi, 1996.
2. Rao, P.N., *Manufacturing Technology, Vol I & II*, Tata McGraw Hill Publishing Co., New Delhi, 1998.

### **REFERENCE BOOKS**

1. Chapman W. A. J., *Workshop Technology Vol. I and II*, Arnold Publisher, New Delhi, 1998.
2. Hajra Choudhary, S. K. and Hajra Choudhary, A. K., *Elements of Manufacturing Technology*, Vol II, Media Publishers, Bombay, 1988.
3. Jain. R. K., *Production Technology*, Khanna Publishers, New Delhi, 1988.
4. Kalpakjian, *Manufacturing Engineering and Technology*, Addison Wesley Congmen Pvt. Ltd., Singapore, 2000.



		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0205</b>	<b>FLUID MECHANICS</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>4</b>
	Prerequisite				
	Nil				

### PURPOSE

To be familiar with all the basic concepts of fluids and fluid flow phenomenon, conservation equations and their applications to simple problems.

### INSTRUCTIONAL OBJECTIVES

1. To familiarize with conservation laws and dimensional analysis to fluid flow problems
2. To familiarize flow through closed conduits and hydraulic machines

### FLUID PROPERTIES AND FUNDAMENTALS OF FLOW

Brief history of fluid mechanics – Fluids and their properties – Continuum, density, viscosity, surface tension, compressibility and bulk modulus, concept of pressure. Fluid statics – Pascal's law, Hydrostatic law – Piezometric head – Manometry

### LAWS OF CONSERVATION

System and Control volume concept, Lagrangian and Eulerian description of fluid flow – Steadiness and uniformity of flow – Acceleration of fluid flow – Stream lines, streak lines, path lines – Rotational and Irrotational flow – One dimensional flow derivations – Euler's momentum equation – Linear and angular momentum – Bernoulli's equation – Application through various examples including flow measuring devices – Orifice meter, Venturi meter.

### DIMENSIONAL ANALYSIS AND FLUID FLOW IN CLOSED CONDUITS

Dimensional Analysis – Buckingham's Pi – theorem, Derivations and applications of important dimensionless numbers, basic modeling and similitude.

Viscous fluid flow – Laminar and turbulent flow, Couette flow between parallel plates, Hagen– Poiseuille flow in circular pipes, Development of flow in pipes, Pipe friction, Darcy-Weissbach equation, Moody's chart, Pipe losses – Major and Minor losses – Problems of parallel, series and branched pipes.

### FLUID FLOW OVER BODIES

Boundary layer theory – boundary layer development on a flat plate, displacement thickness, momentum thickness, momentum integral equation, drag on flat plate – Nature of turbulence, Separation of flow over bodies – streamlined and bluff bodies, Lift and Drag on cylinder and Aerofoil.

### HYDRAULIC MACHINES

Classifications of Pumps– turbines – impulse, reaction turbines – velocity triangles – work done and efficiencies of Centrifugal pump, Pelton wheel, Francis and Kaplan turbines – Performance Comparison of Hydraulic turbines.

### TEXT BOOK

1. Kumar, K.L., *Fluid Mechanics*, 2<sup>nd</sup> Edition, Tata McGraw-Hill, New Delhi, 2000.

### REFERENCE BOOKS

1. Douglas, J. F., Gasiorek and Swaffield, *Fluid Mechanics*, 3<sup>rd</sup> Edition, ELBS/ Pitman, U. K., 1995.
2. Potter, M.C. and Wiggert, D.C., *Mechanics of Fluids*, 2<sup>nd</sup> Edition, Prentice Hall, New Delhi, 1997.
3. Streeter, Victor, Bedford, K.W. and Wylie, E. Benjamin, *Fluid Mechanics*, 2<sup>nd</sup> Edition, Tata McGraw Hill, New Delhi, 1997.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0201</b>	<b>PERSONALITY DEVELOPMENT -III</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

#### **PURPOSE**

The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential

#### **INSTRUCTIONAL OBJECTIVES**

1. To guide thought process.
2. To groom students' attitude.
3. To develop communication skill.
4. To build confidence.

#### **METHODOLOGY**

The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Goal Setting - Problem Solving - Emotional Quotient

Assertiveness - Stress Management - Quiz II

Lateral Thinking (Situational) - Team Work (Role Plays) Impromptu - Text Analysis

Business plan presentation I - Business plan presentation II - Chinese Whisper

Picture Perfect - Case Studies - Review

#### **SCHEME OF INSTRUCTION**

Marks allocated for regular participation in all oral activities in class

#### **SCHEME OF EXAMINATION**

Complete Internal evaluation on a regular Basis

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>IC0217</b>	<b>ELECTRONICS AND INSTRUMENTATION LABORATORY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

#### **PURPOSE**

To study various Basic Circuits of Electronics and Measurements.

#### **LIST OF EXPERIMENTS**

1. Characteristics of Semiconductor Diode and Zener diode.
2. Characteristics of Transistor under Common Emitter Configuration.
3. Characteristics of Transistor Under Common Base Configuration.
4. Characteristics of Transistor Under Common Collector Configuration.
5. Characteristics of UJT and FET.
6. Characteristics of SCR, DIAC and TRIAC.
7. Characteristics of RTD.
8. Characteristics of Thermistor.
9. Characteristics of Thermocouple.
10. Strain Gauge and Load Cell Characteristics.

## REFERENCE

1. Electronic Devices and Measurement Manual

		L	T	P	C
ME0221	MANUFACTURING PROCESS LABORATORY	0	0	2	1
	Prerequisite				
	Nil				

## PURPOSE

To expose hands-on training to the students on various machines like lathe, Shaper, Slotter, Milling, Gear hobbing and grinding machines.

## INSTRUCTIONAL OBJECTIVES

1. Study of various types of lathe operations
2. To Produce flat surface and contour shapes on the given component
3. To know the various methods of making gears
4. To get an idea for making good quality products with good surface finish
5. Application oriented mini projects

## LIST OF EXPERIMENTS

1. Introduction- lathe machine, plain turning, Step turning & grooving (Including lathe mechanisms, simple problems).
2. Taper turning-compound rest/offset method & Drilling using lathe (Including Drilling feed mechanism, Twist drill nomenclature, and Different types of taper turning operations).
3. External threading-Single start (Including Thread cutting mechanism-simple problems)
4. Eccentric turning-Single axis
5. Shaping-V-Block (Including Shaper quick return mechanism)
6. Grinding-Cylindrical /Surface/Tool & cutter
7. Slotting-Keyways (Including Broaching tool nomenclature and Slotter mechanism)
8. Milling-Polygon /Spur gear (Including Milling mechanism, simple problems)
9. Gear hobbing-Helical gear
10. Drilling, reaming, counter boring
11. Planning/Capstan lathe/Burnishing process (Planner Mechanism, Description of capstan and turret lathe)
12. Mini Project work- Application oriented products using above experiments.

**Note:** The following topics also should be covered during this practical course.

Super finishing, Metal spraying, Galvanizing, Electroplating, Anodizing.  
Introduction to non-traditional machining process.

## REFERENCE BOOKS

1. Chapman W. A. J., *Workshop Technology Vol. I and II*, Arnold Publisher, 1996.
2. Hajra Choudhary, S. K. and Hajra Choudhary, A. K., *Elements of Manufacturing Technology Vol II*, Media Publishers, 1986.
3. Laboratory Manual.

		L	T	P	C
ME0223	FLUID DYNAMICS LABORATORY	0	0	2	1
	Prerequisite				
	Nil				

## PURPOSE

To enable the students to acquire knowledge of flow meters.

Give student insight into working of various fluid machines and be able to compare performance of fluid machines under different working conditions

**INSTRUCTIONAL OBJECTIVES**

1. Gain knowledge on working of centrifugal pumps, positive displacement pumps, hydraulic turbines centrifugal blowers and steam turbines
2. Able to compare performance of various machines at different operating points
3. To gain the knowledge of various flow meters and the concept of fluid mechanics

**LIST OF EXPERIMENTS****PART A – FLUID MECHANICS**

1. Determination of coefficient of discharge of orifice meter
2. Determination of coefficient of discharge of venturi meter
3. Major losses in pipe flow
4. Verification of Bernoulli's theorem
5. Minor losses – expansion and contraction losses in pipes

**PART B – HYDRAULIC MACHINES**

1. Performance test on centrifugal pumps
2. Performance test on reciprocating pumps
3. Performance test on gear pumps
4. Performance test on deep well or submersible or jet pumps
5. Performance test on Pelton turbine or Francis turbine

**PART C – FLUID MACHINES (working medium-air)**

1. Performance test on centrifugal blower with different impellers.
2. Performance test on reciprocating air compressor
3. Aerodynamic studies on isolated aerofoil in wind tunnel

**REFERENCE**

1. Laboratory manual

**SEMESTER IV**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE0202</b>	<b>GERMAN LANGUAGE PHASE - II</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
	<b>Prerequisite</b>				
	<b>GERMAN LANGUAGE PHASE - I</b>				

**PURPOSE**

Enabling the Engineering Students to one more Foreign Language, especially German, which is scientific and technical language. This may be useful in the field of employment opportunities as well as helping them to develop projects on browsing German websites.

**INSTRUCTIONAL OBJECTIVES**

Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own C V and developing a fundamental conversation with any German national.

**SPEAKING**

Dialogue – Questioning / Basic queries / Conversational with practical exposure.

**GRAMMATIK (WRITING)**

Verben, Wortstellung, Nomen, Pronomen, Artikel, Nominitativ, Akkusativ, Dativ, Adjective, Prasens, Perfect and Neben Satze.

**GLOSSARY**

Technical words. Lesson (6-10)

**TEXT BOOK WITH CASSETTES**

- A. Grundkurs Deutsch
- B. Momentmal

(Prescribed by Max Mueller Bhavan – Goethe Institute, Germany).

**SCHEME OF EVALUATION**

Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE0204</b>	<b>JAPANESE LANGUAGE PHASE II</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
	<b>Prerequisite</b>				
	<b>JAPANESE LANGUAGE PHASE I</b>				

**PURPOSE**

1. In view of globalization, learning Foreign Language by Engineering graduates enhances their employment opportunities.
2. Get awareness of understanding of International culture.
3. Widening the Linguistic Skills of the Students.

**INSTRUCTIONAL OBJECTIVES**

To learn the scripts of Japanese Languages namely Hiragana, Katakana and Kanji, Vocabularies etc. To learn basic grammar and acquire basic communication skills. To understand Japanese culture.

Lesson 2-{Korewa Tsukue desu } – Grammar, Sentence pattern, Marume .  
Conversation

Lesson 3 – [Kokoni denwa ga arimasu] - Grammar, Sentence pattern, Marume .Conversation

Lesson 4– {Asokoni hito ga imasu} - Grammar, Sentence pattern, Marume .

Lesson 5– {Akairingo wa ikutsu arimasu ka}-Grammar, Sentence pattern, Marume . Conversation.

Lesson 6– {Barano hana wa ippon ikura desu ka}- Grammar, Sentence pattern.Marume.Conversation.

**TEXT BOOKS**

1. Nihongo Shoho Imain Text sold in India by the Japanese Language Teachers Association Pune.
2. Hiragana and Katakana Work Book published by AOTS Japan
3. Grammar and Kotoba ( Work Book )
4. Japanese for Dummies.(Conversation) CD.

**SCHEME OF EVALUATION**

Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>LE0206</b>	<b>FRENCH LANGUAGE PHASE II</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
	<b>Prerequisite</b>				
	<b>FRENCH LANGUAGE PHASE I</b>				

**PURPOSE**

1. As language skills are as valuable as technical skills a knowledge of French enables the engineering graduates in career orientation.
2. As a second international global Lang after English there is a wider choice of job opportunities in the inter national employment market and also multinationals in India and an understanding of French culture thro language.

**INSTRUCTIONAL OBJECTIVE**

Characterised by the Roman script, grammar, vocabulary and colloquial expressions are taught which enables them to communicate effectively with any native speaker.

Sports (Ski, natation, tennis, Tour de France), Cuisine (French dishes), Cinema (Review of a film) – Articles on these topics and group discussion will be followed.

### GRAMMAR

Possessive Adjectives, Demonstrative Adjectives, Past tense – Passé Composé( Verbe Auxiliaire: Etre et Avoir)

Culture and Civilization French Monuments (Tres celebres), French History (Jeanne d' Arc, Louis XIV, Prise de la Bastille), Culture and Civilisation (vin, fromage, mode, parfums)

Transport system, government and media in France – articles on these topics.

Comprehension and Grammar Comprehension passages and conversational sentences in different situations (at the restaurant, at the super market)

### TEXT BOOK:

1. Panorama – Goyal Publishers
2. Apprenons le Francais II, Sarawathy Publications

### SCHEME OF EVALUATION

Internal 50 = Listening – 10 Marks, Speaking – 20 Marks, Reading – 10 Marks and Writing = 10 Marks

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MA0202</b>	<b>NUMERICAL METHODS</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>4</b>
	Prerequisite				
	Mathematics I & II				

### PURPOSE

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

### INSTRUCTIONAL OBJECTIVES

At the end of the course, student should be able,

1. To be familiar with numerical solution of equations
2. To get exposed to finite differences and interpolation
3. To be thorough with the numerical Differentiation and integration
4. To find numerical solutions of ordinary and partial differential equations

### CURVE FITTING AND NUMERICAL SOLUTION OF EQUATIONS

Method of Least Squares – Fitting a straight line – Fitting a parabola – Fitting an exponential curve – Fitting a curve of the form  $y = ax^b$  – Calculation of the sum of the squares of the residuals.- Newton-Raphson method – Gauss Elimination method – Gauss Jacobi method – Gauss Seidel method.

### FINITE DIFFERENCES AND INTERPOLATION

First and Higher order differences – Forward differences and backward differences and Central Differences – Differences of a polynomial – Properties of operators – Factorial polynomials – Shifting operator E – Relations between the operators. Interpolation – Newton-Gregory Forward and Backward Interpolation formulae – Divided differences – Newton's Divided difference formula – Lagrange's Interpolation formula – Inverse interpolation.

### NUMERICAL DIFFERENTIATION AND INTEGRATION

**Numerical Differentiation and Integration:** Newton's forward and backward differences formulae to compute first and higher order derivatives – The Trapezoidal rule – Simpson's one third rule and three eighth rule.

### NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS

Solution by Taylor's series – Euler's method – Improved and modified Euler method – Runge-Kutta methods of fourth order (No proof) – Milne's Method - Adam's Bashforth method.

### NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of Partial differential equations of the second order - Difference quotients – Laplace’s equation and its solution by Liebmann’s process – Solution of Poisson’s equation – Solutions of Parabolic and Hyperbolic equations.

### TEXT BOOK

1. B.S. Grewal, Numerical Methods, Khanna Publishers, 6<sup>th</sup> edition.  
(Unit I – Chapter 5 Section 5.3, 5.5, 5.6, 5.8, Chapter 2 Section 2.1, 2.9, 2.10, 2.12, Chapter 3 Section 3.4 (4), 3.5(1,2), Chapter 4 Section 4.2 Unit II – Chapter 7 Section 7.1, 7.2, 7.4, 7.12 – 7.14 Chapter 6 Section 6.6, 6.7 Unit III – Chapter 8 Section 8.2, 8.10 (1,2), 8.41 – 8.43 Unit IV – Chapter 10 Section 10.3 - 10.6, 10.8 – 10.10 Unit V – Chapter 11 section 11.3 – 11.6, 11.8, 11.9(1,2), 11.11,11.12).

### REFERENCE BOOKS

1. Dr. M.K. Venkataraman, Numerical Methods in Science and Engineering, National Publishing Co., 1999.
2. S.S. Sastry, Introductory Methods of Numerical Analysis, 2001.
3. E. Balagurusamy, Computer Oriented Statistical and Numerical Methods – Tata McGraw Hill., 2000.
4. M.K.Jain, SRK Iyengar and R.L.Jain, Numerical Methods for Scientific and Engineering Computation, Wiley Eastern Ltd., 1987.
5. M.K.Jain, Numerical Solution of Differential Equations, 1979.
6. Dr.P.Kandasamy et al., Numerical Methods, S.Chand & Co., New Delhi, 2003.

		L	T	P	C
ME0204	MECHANICS OF SOLIDS	3	2	0	4
	Prerequisite				
	Nil				

(Use of approved design data book is permitted)

### PURPOSE

To familiarize the students with the fundamentals of deformation, stresses, strains in structural elements.

### INSTRUCTIONAL OBJECTIVES

Students will be able to

1. Know the concepts of stress and strain
2. Analyze the beam of different cross sections for shear force, bending moment, slope and deflection
3. Understand the concepts necessary to design the structural elements and pressure vessels.

### CONCEPT OF STRESSES AND STRAINS

Concept of stress and strain, Hooke’s law – Tension, Compression, and Shear, stress-strain diagram – Poisson’s ratio, elastic constants and their relationship – Deformation of simple and compound bars – Thermal stresses. Principal plane, principal stress, maximum shearing stress – Uniaxial, biaxial state of stress – Mohr’s circle for plane stresses.

### ANALYSIS OF BEAMS

**Beams:** Types and Transverse loadings – shear force and bending moment diagrams for cantilevers, simply supported and over hanging beams. **Theory of pure bending:** Bending stresses in simple and composite beams. Shear stress distribution in beams of different sections.

### TORSION OF SHAFTS AND SPRINGS

Theory of pure torsion, torsion of circular shafts, simple problems – Type of springs, stiffness, springs in series, springs in parallel, stresses and deflections in helical springs and leaf springs – Design of helical springs and leaf springs.

### DEFLECTION OF BEAMS

Slope and deflection of cantilever, simply supported, fixed beam by double integration method – Macauley’s method – Moment area method – Strain energy method – Castigliano’s theorem.

### COLUMN AND STRUTS

Member subjected to combined bending and axial loads, Euler’s theory, Crippling load, Rankine’s theory.

**Cylinders And Shells :** Thin cylinder, thin spherical shells under internal pressure – Thick cylinders – Lamé’s equation – Shrink fit and compound cylinders.

### TEXT BOOKS

1. Bansal, R.K., *A Text Book of Strength of Materials*, Lakshmi Publications Pvt. Limited, New Delhi, 1996.
2. Prabhu, T.J., *Design of machine elements*, Private Publication, 1999.
3. Ferdinand P. Beer, and Russell Johnston, E., *Mechanics of Materials*, SI Metric Edition, McGraw Hill, 1992.

### REFERENCE BOOKS

1. William A. Nash, *Theory and Problems of Strength of Materials*, Schaum's Outline Series, McGraw Hill International Edition, 3<sup>rd</sup> Edition, 1994.
2. Srinath, L. S., *Advanced Mechanics of Solids*, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1987.
3. Popov, E. P., *Mechanics of Materials*, 2<sup>nd</sup> edition, Prentice Hall of India Private Limited, New Delhi, 1989.
4. James M. Gere, *Mechanics of Materials* Fifth Edition, Brooks/Cole, USA, 2001.
5. Shigley, J. E., *Applied Mechanics of Materials*, International Student Edition, McGraw Hill Koyakusha Limited, 2000.
6. Maitra, *Handbook of Machine Design*, Tata McGraw Hill, New Delhi, 1986.
7. *Design Data*, PSG College of Technology, 2000.

		L	T	P	C
ME0206	APPLIED THERMAL ENGINEERING	3	2	0	4
	Prerequisite				
	Nil				

### PURPOSE

On completion of this course, the students are exposed to understand the concept and working of gas, vapour power cycles, air compressors, refrigeration and air conditioning systems.

### INSTRUCTIONAL OBJECTIVES

1. To study air/vapour cycles with reheat and regeneration
2. Performance study of compressors are introduced
3. Knowledge of eco-friendly refrigerants, refrigeration and air conditioning systems

### GAS POWER CYCLES

Air standard cycles – Assumptions – Otto, Diesel, Dual-air standard efficiency – mean effective pressure and power; Brayton cycle – reheat and regeneration. (Elementary treatment only)

### VAPOUR POWER CYCLES

Rankine cycle – performance – simple, reheat and regenerative cycle – Introduction to Binary vapour cycle (Elementary treatment only)

### AIR COMPRESSORS

Reciprocating air compressors – types – construction – work of compression without clearance – effect of clearance – multistage – optimum intermediate pressure for perfect intercooling – compressor efficiencies and mean effective pressure.

Rotary compressors – Vane compressor, Roots blower (construction and working only)

### REFRIGERATION SYSTEMS

Types of refrigeration systems – vapour compression and vapour absorption systems – working principle, refrigerants – properties. Eco friendly refrigerants.

Analysis of vapour compression refrigeration cycle, use of P-h chart, effect of sub cooling and superheating – calculations of C.O.P (ammonia, R134a, R12 and R22 only)

### PSYCHROMETRY AND AIR CONDITIONING

Properties of atmospheric air – psychrometric chart, psychrometric processes: Sensible heating and cooling, Cooling and dehumidification– Heating and humidification.

Description of summer, winter and year round air conditioning system, description of window and split air conditioning system, Cooling load calculations – simple problems only.



**TEXT BOOKS**

1. Rajput, R. K., *Thermal Engineering*, Laxmi Publications, 6<sup>th</sup> Edition, New Delhi, 2006.
2. Domkundwar, A., *A Course in Thermal Engineering*, Dhanpat Rai & Co., New Delhi, 2000.

**REFERENCE BOOKS**

1. Sarkar, B. K., *Thermal Engineering*, 3<sup>rd</sup> Edition, Tata McGraw Hill, New Delhi, 2006.
2. Arora, S. C., Domkundwar, C. S., *A course in Refrigeration and Air Conditioning*, 4<sup>th</sup> Edition, New Age International (p) Ltd., New Delhi, 2002.

		L	T	P	C
ME0208	MACHINES AND MECHANISMS	3	2	0	4
	Prerequisite				
	Nil				

**PURPOSE**

To expose the students to learn the fundamentals of various laws governing rigid bodies and their motions.

**INSTRUCTIONAL OBJECTIVES**

1. Basic mechanisms, velocity and acceleration of simple mechanisms
2. Drawing the profile of cams and its analysis
3. Friction applications, gear train calculations
4. Balancing of machines.

**MECHANISMS**

Introduction – Links – Pairs – Chain – Mechanism – Machine structure – Degrees of freedom – Four bar chains – Terminology and definition – Planer, Spherical and Spatial Mechanisms – Grashoff's law – Kutzbach criterion – Grubler's criterion for plane mechanism. Inversion of mechanisms – Four bar, single slider crank and double slider crank mechanisms – Simple problems – Instantaneous centre – Kennedy's theorem – Velocity and Acceleration of Four bar and single slider crank mechanisms by relative velocity Method.

**ADVANCED MECHANISMS AND CAMS**

Pantograph – Steering gear mechanism – Davis Steering gear – Ackerman steering gear – Hooke's joint – Double Hooke's joint.

**CAMS:** Types of cams and followers – Follower motion – Uniform, Parabolic, SHM and cycloidal. Cam terminology – Cam profiles construction for roller, flat faced and knife edge follower types – pressure angle.

**FRICTION**

**Friction:** Applications – Screw friction – Effort calculations –Efficiency– Self locking and overhauling of screws. Friction clutches – disc, cone clutches – Working principle – Torque, Power transmitted derivations and calculations.

**GEAR TRAINS AND CONTROL MECHANISMS**

Spur gear terminology and definition – Gear trains: simple, compound, reverted and epicyclic – Velocity ratio and torque calculation in gear trains – Automobile differential.

**Gyroscopes:** Gyroscopic forces and couple – Forces on bearing due to gyroscopic action – Gyroscopic effect in ship, motor cycle, car and aircraft. **Concept of governors:** (elementary treatment only)

**TURNING MOMENT DIAGRAM AND BALANCING**

**Turning moment diagrams:** Fly wheels – Application of flywheel – Punching presses.

**Static and dynamic Balancing:** Balancing of rotating masses – Balancing of single cylinder engine – Balancing of multi cylinder engine – Balancing machines.

**TEXT BOOKS**

1. Ratan, S.S., *Theory of Machines*, Tata McGraw Hill Publishing company Ltd., 2<sup>nd</sup> Edition ,2005
2. Thomas Bevan, *Theory of Machines*, CBS Publishers and Distributors, 3<sup>rd</sup> Edition, 1984.

**REFERENCE BOOKS**

1. Shigley, J. E., and Uicker, J. J., *Theory of Machines and Mechanisms*, McGraw Hill, 1995.

2. Ghosh, A., and Mallick, A. K., *Theory of Mechanisms and Machines*, Affiliated East-West Pvt Ltd., New Delhi, 1988.
3. Rao, J. S., and Dukkupati, R.V., *Mechanism and Machine Theory*, Wiley-Eastern Ltd., New Delhi, 1995.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0210</b>	<b>COMPUTER AIDED DESIGN AND ANALYSIS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

### **PURPOSE**

To study how computer can be applied in mechanical engineering design.

### **INSTRUCTIONAL OBJECTIVES**

To familiarize with

1. Concepts of modeling in 2D and 3D.
2. Concepts of computer graphics.
3. CAD Packages and its features.
4. Theory of analysis and its implementation in CAD.

### **INTRODUCTION**

Introduction to Design process - CAD. **Geometric Modeling:** Types – Wireframe, surface and solid modeling.

**Solid modeling techniques:** CSG and B-rep – Operations: Boolean – Extrude - Sweep - Revolve. Entities – Line – Circle – Ellipse – Parabola - Cubic Spline, Bezier and B-spline (Basic treatment only).

### **GRAPHICS CONCEPTS (2D and 3D)**

Coordinate systems – Transformations: translation, scaling, reflection, rotation - Concatenated transformation - Inverse transformation. Hidden line removal - Shading - Colouring - Rendering – Animation (Basic treatment only).

### **SOFTWARE PACKAGES AND RECENT TECHNOLOGY**

Commercial solid modeling packages: Salient features - Technical comparison - Modules and tools - Brief outline of data exchange standards. Brief outline of feature technology: Classification of features - Design by features - Applications of features - Advantages and limitations.

### **FEM FUNDAMENTALS**

Introduction – Steps involved in FEA: Nodes - Elements and their types, shape function, constraints, forces and nodal displacements - Stiffness matrix - Solution techniques. Analysis of spring element. Simple problems involving stepped bar subject to axial loading and simple structural members with triangular element.

### **ANALYSIS**

**FEA in CAD Environment:** Stages of FEA in CAD environment – Preprocessor - Solver and postprocessor.

Demonstration of the above using any one commercial packages. Brief outline of kinematic analysis - Manufacturability analysis and simulation (Basic treatment only).

### **TEXTBOOKS**

1. Ibrahim Zeid, *CAD / CAM – Theory and Practice*, Tata Mcgraw-Hill, New Delhi, 2001.
2. Radhakrishnan. P., *CAD / CAM / CIM* - New age international, 2000.
3. Chairs McMahon and Jimmie Browne, *CAD/CAM*, Addison Wesley, New York, 2000.

### **REFERENCE BOOKS**

1. Chandupatla and Belagundu, *Introduction to Finite Element Methods in Engineering*, Prentice Hall of India Private Limited, New Delhi, 1997.
2. Newman and Sproull R. F., *Principles of interactive computer graphics*, Tata Mcgraw-Hill, New Delhi, 1997.
3. Mikell P. Groover, *CAD/CAM*, Prentice Hall of India Private Limited, New Delhi, 1997.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD 0202</b>	<b>PERSONALITY DEVELOPMENT - IV</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

#### **PURPOSE**

The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential

#### **INSTRUCTIONAL OBJECTIVES**

1. To guide thought process.
2. To groom students' attitude.
3. To develop communication skill.
4. To build confidence.

#### **METHODOLOGY**

The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Motivation II - Interpretation of Visuals of I & II

Humor in real life - Body language - Collage and poster designing and slogan writing

Brain Teasers – JAM - Current News Update I

Current News Update II - Enactment (SKIT –I) - Enactment (SKIT – II)

Survey and Reporting (heroes, sports persons etc.) - Quiz III - Review

#### **EVALUATION:**

1. Activities assessed by both group and individual participation
2. Continuous assessment based on daily participation

#### **SCHEME OF INSTRUCTION**

Marks allocated for regular participation in all oral activities in class

#### **SCHEME OF EXAMINATION**

Complete Internal evaluation on a regular Basis

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0222</b>	<b>STRENGTH OF MATERIALS LABORATORY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	Prerequisite				
	Nil				

#### **PURPOSE**

To familiarize the students with the use of stress, strain measuring instruments.

#### **INSTRUCTIONAL OBJECTIVES**

1. The students will be able to understand procedures for conducting tensile, torsion tests on mild steel specimens.
2. Determine the Young's modulus using deflection test on beams and tensile test on rods, tension and compression test on springs, bricks, concrete, and impact tests on steel.

## LIST OF EXPERIMENTS

1. Tensile test on mild steel rod.
2. Torsion test on mild steel rod.
3. Deflection test on steel and aluminium specimen.
4. Charpy and Izod impact test on steel specimen.
5. Double shear test on steel rod.
6. Compression test on brick and concrete blocks.
7. Tension and compression test on helical springs.
8. Brinell and Rockwell hardness test.

## REFERENCE BOOKS

1. Kazimi, S. M. A., *Solid Mechanics*, First Revised Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 1994.
2. Laboratory Manual

		L	T	P	C
ME0224	COMPUTER AIDED DESIGN LABORATORY	0	0	2	1
	Prerequisite				
	Nil				

## PURPOSE

To provide hands-on training to the students on various software in mechanical engineering

## INSTRUCTIONAL OBJECTIVES

To familiarise with

1. Drafting practice using computer
2. Modeling of 2D and 3D parts
3. Assembly of modeled parts
4. Analysis of modeled parts

## COMPUTER AIDED DRAFTING OF MACHINE ELEMENTS

Orthographic views - Isometric views - Sectional views. Dimensioning - Annotations - Symbols - Welding - Surface finish - Threads. Text - Bill of Materials- Title block. Exercise: Knuckle, Gib and Cotter Joint - Screw Jack - Foot step bearing.

## GEOMETRIC MODELING OF MACHINE COMPONENTS

Protrusion- cut – Sweep – Revolve - Draft and loft - Modify/edit – Pattern – Transformation - Boolean operation. Exercise: Individual parts of Universal Joint - Flange Coupling - Piston and Connecting rod.

## CONVERSION OF 3D TO 2D

Conversion of 3D to 2D and Mass property calculations for parts created in Units I and II.

## ASSEMBLY OF MACHINE PARTS

Exercise: Assemble from parts created in Unit II.

## FINITE ELEMENT ANALYSIS

FEA of simple structural members - Cantilever beam - Simply supported beam and a plate with a hole.

## REFERENCE

Laboratory Manual.

		L	T	P	C
ME0226	MANUFACTURING AND ASSEMBLY DRAWING	1	0	3	2
	Prerequisite				
	Nil				

## PURPOSE

To enable the engineering students to draw a detailed production and assembly drawing for given components

## INSTRUCTIONAL OBJECTIVES

At the end of this course the student should be able to understand

1. Indian codes and standards for engineering drawing
2. Representation of Fits and Tolerances in technical drawing
3. Assembly drawing of machine elements
4. Production drawing of components

## TECHNICAL DRAWING STANDARDS

Indian Standard Code of practice for Engineering Drawing: General principles of presentation, conventional representation of dimensioning and sectioning, conventional representation of threaded parts, gears, springs and common features. Abbreviations and symbols used in technical drawings. Symbols and method of indication on the drawing for surface finish, welding and riveted joints.

## FITS AND TOLERANCES

Tolerance types and representation on the drawing – Fits types and selection for different applications – Basic hole systems - Basic shaft systems – Allowances. Geometric tolerances – Form and positional. Datum and datum features symbols used to represent geometric tolerances.

## ASSEMBLY DRAWING OF JOINTS, COUPLING AND BEARINGS

Preparation of drawing for keys and keyways, cotter joints, pin joints and screwed fasteners. Preparation of drawing for Couplings - Flanged coupling and universal coupling, Bearings: Plummer block - Foot step bearing. Representation of tolerances in drawing.

## PRODUCTION DRAWING

Preparation of production drawing for simple components, interpretation of production drawings.

## ASSEMBLY DRAWING OF MACHINE ELEMENTS

Preparation of assembled views given parts details - Lathe tail stock - Lathe chuck - Connecting rod - Screw jack, machine vice, tool head of shaper and stop valve. Representation of tolerances in drawing.

## NOTE:

Examination must include an assembly drawing of machine elements.

## TEXT BOOKS

1. Gopalakrishnan, K.R., *Machine Drawing*, Subash Publishers, Bangalore, 2000.
2. Narayana, K.L., Kanniah, P. and Venkata Reddy, K., *Production Drawing*, New Age International, New Delhi, 2002.

## REFERENCES

1. Sidheswar Kannaiah, N., Sastry, P.V.V.V., *Machine Drawing*, Tata McGraw Hill, New Delhi, 1997.
2. Bhatt, N. D., *Machine Drawing*, Charotar publishing house, Anand, 1999.
3. Junnarkar, N. D., *Machine Drawing*, First Indian print, Pearson Education (Singapore) Pvt. Ltd., 2005.
4. *P.S.G. Design Data Book*, Coimbatore, 2001.
5. Revised IS codes: 10711, 10712, 10713, 10714, 9609, 1165, 10715, 10716, 10717, 11663, 11668, 10968, 11669, 8043, 8000.

## SEMESTER V

		L	T	P	C
ME0301	FUNDAMENTALS OF VIBRATION AND NOISE	3	2	0	4
	Prerequisite				
	Nil				

## PURPOSE

To familiarize the students with the sources of vibration and noise in machines and make design modifications to reduce the vibration and noise and improve the life of the components

## INSTRUCTIONAL OBJECTIVES

Students will be able to

1. Know the concepts of vibration and noise
2. Analyze the Single Degree, Two Degree and Multi degree of Freedom Systems
3. Understand the case studies on the field of Vibration
4. Identify the sources of noises and the ways to control it.

### **SIMPLIFICATION OF VIBRATION PROBLEMS TO ONE DEGREE OF FREEDOM**

Basic equation of motion for various vibration problems – Torsional, Free, Damped and Forced vibration problems, critical speed, nature of exciting forces, vibration isolation, vibration instruments.

### **TWO AND MULTI-DEGREE OF FREEDOM SYSTEMS**

Two degree – Formulation of solution - Coupling between rotating and translation - Applications.

Multi degree – Governing equation for closed coupled systems - Lateral vibration, Geared systems - Effect of gyroscopic acceleration.

### **SOLUTION OF VIBRATION PROBLEMS**

Approximate methods (or) Numerical methods – Holzer's method, Myklestad's method, Sturgen sequence

Energy methods – Rayleigh's Approach – Closed coupled systems. For coupled systems – Dunkerley's method, Rayleigh Ritz method.

### **DIAGNOSTICS AND FIELD MEASUREMENT**

Diagnostic tools - Condition monitoring in real time - Balancing of rotors - Field measurements on various compressors, fans, machine foundation.

### **MACHINERY NOISE AND CONTROL**

Basics of noise - Introduction, amplitude, frequency, wavelength and sound - Pressure level, noise dose level - Measurement and analysis of noise. Methods for control of noise - Mechanical noise - Predictive analysis, Sound in enclosures - Sound energy absorption - Sound transmission through barriers.

### **TEXT BOOKS**

1. Ramamurti, V., *Mechanical Vibration Practice with Basic Theory*, 1<sup>st</sup> edition, Narosa Publishing House, Chennai, 2000.
2. Kewel Pujara., *Vibration and noise for engineers*, Dhanpat rai & Sons, 1992.

### **REFERENCE BOOKS**

1. Rao, J. S. and Gupta, K., *Introductory course on theory and practice of mechanical vibrations*, Wiley Eastern, New Delhi, 1984.
2. Rao, S. S., *Mechanical vibrations*, 3<sup>rd</sup> Edition, Addison Wesley publishing company, New York, 1995.
3. Thomson, W. T., *Theory of Vibration and its Applications*, Prentice Hall, New Delhi, 1982.
4. Meirovitch, L., *Elements of Vibration Analysis*, Mc Graw-Hill Book Co., New York., 1986.
5. Keith Mobley, R., *Vibration Fundamentals*, Plant Engineering Maintenance Series, Elsevier, 2007.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0307</b>	<b>MATERIALS TECHNOLOGY</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

### **PURPOSE**

On completion of the course the student will have knowledge about the technology of different materials and their applications.

### **INSTRUCTIONAL OBJECTIVES**

This course will enable the students to know more about

1. Different materials with their properties,
2. Various production techniques and applications,
3. Fracture analysis for different metals,
4. Strengthening mechanisms and
5. Applications of metallic and non metallic materials.

## ELASTIC AND PLASTIC BEHAVIOUR

Elasticity in metals and polymers – Mechanism of plastic deformation – Role of yield stress, shear strength of perfect and real crystals – Strengthening mechanisms, work hardening - Solid solutioning, grain boundary strengthening, particle, fibre and dispersion strengthening - Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity – Deformation of non-crystalline material.

## FRACTURE BEHAVIOUR

Griffith's theory, stress intensity factor and fracture toughness – Ductile to brittle transition – High temperature fracture, creep – Deformation mechanism maps – Fatigue, Low and high cycle fatigue test crack initiation and propagation mechanisms - Fracture of Non-metallic materials – Failure analysis, Sources of failure, procedure of failure analysis.

## PHASE DIAGRAMS

Introduction - Solid solutions - Intermediate phases – Phase rules – Free energy in intermediate phases – Phase diagrams – Phase changes in alloys – Determination of phase diagrams - Ternary phase diagrams – Cooling curves – Equilibrium diagrams of Iron and Iron – Carbide diagram – Definition of structures.

## MODERN METALLIC MATERIALS

Dual phase alloys - Micro alloyed steels, High Strength Low alloy (HSLA) steel - Transformation induced plasticity (TRIP) steel, Maraging steel – Intermetallics, Ni and Ti aluminides – Smart materials - Shape memory alloys – Metallic glasses – Quasi crystals and nano crystalline materials.

## NON METALLIC MATERIALS

Polymeric materials – Formation of polymer structure – Production techniques of fibre, foams, adhesives and coating – structure and properties and applications of engineering polymers – Advanced structure ceramics, WC, TiC, Al<sub>2</sub>O<sub>3</sub>, O<sub>2</sub>, SiC, Si<sub>3</sub>N<sub>4</sub>, CBN and Diamond – Properties, processing and applications.  
Composite materials: Types, production techniques, structure, properties and applications.

## TEXT BOOKS

1. Dieter, G. E., *Mechanical Metallurgy*, McGraw Hill, Singapore, 2001.
2. Thomas H. Courtney, *Mechanical Behaviour of Engineering materials*, McGraw Hill, Singapore, 2000.

## REFERENCE BOOKS

1. Flinn, R. A. and Trojan, P. K., *Engineering Materials and their applications*, Jaico, Bombay, 1989.
2. Budinski K.G. and Budinski, M. K., *Engineering Materials Properties and selection*, Prentice Hall of India Private Limited, New Delhi, 2004.
3. ASM Metals Hand book, *Failure analysis and prevention*, Vol: 10, 14<sup>th</sup> edition, New York, 2002.

		L	T	P	C
AE 0301	THEORY OF AUTOMOTIVE ENGINES	3	2	0	4
	Prerequisite				
	Nil				

## PURPOSE

The purpose of this course is to impart knowledge about automotive SI and CI engines.

## INSTRUCTIONAL OBJECTIVES

At the end of the course, the student will be able to understand:

1. Construction and operation of IC engine,
2. Fuels and combustion of fuels in SI and CI engine,
3. Conduct performance test and carry out calculations

## ENGINE CONSTRUCTION AND OPERATION

Four stroke SI and CI engines - Working principle - function, materials, constructional details of engine components - Valve timing diagram - Firing order and its significance - relative merits and demerits of SI and CI engines

Two stroke engine construction and operation. Comparison of four-stroke and two-stroke engine operation.

## FUELS AND COMBUSTION

Combustion equation, conversion of gravimetric to volumetric analysis - Determination of theoretical minimum quantity of air for complete combustion – Determination of air fuel ratio for a given fuel.

Properties and rating of fuels (petrol and diesel), chemical energy of fuels, reaction equation, properties of air/fuel mixture, combustion temperature, combustion chart.

## COMBUSTION IN SI ENGINES

Combustion in premixed and diffusion flames - Combustion process in IC engines. Stages of combustion - Flame propagation - Flame velocity and area of flame front - Rate of pressure rise - Cycle to cycle variation – Abnormal combustion - Theories of detonation - Effect of engine operating variables on combustion. Combustion chambers – types, factors controlling combustion chamber design.

## COMBUSTION IN CI ENGINES

Importance of air motion - Swirl, squish and turbulence - Swirl ratio. Fuel air mixing - Stages of combustion - Delay period - Factors affecting delay period, Knock in CI engines – methods of controlling diesel knock. CI engine combustion chambers – Combustion chamber design objectives - open and divided. Induction swirl, turbulent combustion chambers. - Air cell chamber – M Combustion chamber.

## ENGINE PERFORMANCE

Performance parameters – BP, FP, IP, specific fuel consumption, volumetric efficiency, thermal efficiency, mechanical efficiency, specific weight, and heat balance. Testing of engines – different methods. Numerical problems

## TEXT BOOKS

1. Ganesan. V, *Internal combustion engines*, 2<sup>nd</sup> edition, Tata McGraw Hill Publishing Co, 2003.
2. Rajput. R. K, *A textbook of Internal Combustion Engines*, Laxmi Publications (P) Ltd, 2005.

## REFERENCE BOOKS

1. John. B, Heywood, *Internal Combustion Engine Fundamentals*, McGraw Hill Publishing Co., New York, 1990.
2. Sharma. S. P, Chandramohan, *Fuels and Combustion*, Tata McGraw Hill Publishing Co, 1987.
3. Mathur and Sharma, *A course on Internal combustion Engines*, Dhanpat Rai & Sons, 1998.

		L	T	P	C
AE 0303	AUTOMOTIVE CHASSIS	3	2	0	4
	Prerequisite				
	Nil				

## PURPOSE

To familiarize the students with the fundamentals of Automobile Chassis.

## INSTRUCTIONAL OBJECTIVES

Students will be able to

1. Know the basics of Automobile Chassis Components.
2. Construction and Working principle of Front Axle, Rear Axle, Wheels, Tyres, Final Drive, Steering System, Brakes and Suspension System.

## INTRODUCTION

Types of chassis layout with reference to power plant locations and drive, Vehicle frames. Various types of frames. Constructional details, Materials. Testing of vehicle frames. Unitised frame body construction: Loads acting on vehicle frame.

## FRONT AXLE AND STEERING SYSTEM

Types of front axles. Construction details. Materials. Front wheel geometry viz. Castor, Camber, King pin inclination, Toe-in - Conditions for true rolling motion of wheels during steering, turning radius, Wheel wobble and shimmy. Ackerman and Davis steering system. Constructional details of steering linkages. Different types of steering gear boxes. Steering linkages and layouts for conventional and independent suspension system. Power and power assisted steering.



### **DRIVE LINE, REAR AXLE, FINAL DRIVE, AND DIFFERENTIAL**

Effect of driving thrust and torque reactions. Hotch kiss drive, torque tube drive and radius rods. Propeller shaft. Universal joints. Constant velocity universal joints. Front wheel drive.

Construction of rear axles. Types of loads acting on rear axles. Full floating. Three quarter floating and semifloating rear axles. Rear axle housing. Construction of different types of axle housings. Multi axled vehicles. Construction details of multi drive axle vehicles.

Different types of final drive. Double reduction and twin speed final drives. Differential principles. Constructional details of differential unit. Non-slip differential. Differential lock - Differential housing.

### **SUSPENSION SYSTEM**

Need of suspension system - Types of suspension - Suspension springs - Constructional details and characteristics of leaf, coil and torsion bar springs - Independent suspension - Rubber suspension - Pneumatic suspension - Hydro Elastic suspension - Shock absorbers. Vibration and driving comfort.

### **BRAKING SYSTEM, WHEELS AND TYRES**

Necessity of brake, stopping distance and time, brake efficiency, weight transfer, shoe brake and disc brake theory. Determination of braking torque. Brake actuating systems - Mechanical, Hydraulic and Pneumatic - Detailed study of components. Parking and engine exhaust brakes. Factors influencing brake performance. Power and power assisted brakes. Antilock Braking System (ABS).

Types of wheels - construction. Function of tyres - Solid and pneumatic Tyres. Constructional details of pneumatic tyres.

### **TEXT BOOKS**

1. Tim Gilles, *Automotive Chassis-Brakes, Steering and Suspension*, Thomson Delmer Learning, 2005
2. Heldt P. M., *Automotive Chassis*, Chilton Co., New York, 1990.

### **REFERENCE BOOKS**

1. Birch, *Automotive Braking Systems*, Thomson Asia, 1999.
2. Birch, *Automotive Chassis Systems*, Thomson Asia, 2000.
3. Birch, *Automotive Suspension and Steering Systems*, Thomson Asia, 1999.
4. Newton, Steeds & Garrot, *The Motor vehicle*, SAE - Butterworths, India, 13<sup>th</sup> edition, 2001.
5. Judge A.W., *Mechanism of the car*, Chapman and Halls Ltd., London, 1986.
6. John Peter Whitehead, Donald Bastow, *Car Suspension and Handling*, 4th Edition, Allied publishers limited, SAE Department, 2004

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD0301</b>	<b>PERSONALITY DEVELOPMENT - V</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

### **PURPOSE**

The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential

### **INSTRUCTIONAL OBJECTIVES**

At the end of the course the students will be able to

1. Acquire the important soft skills for employment
2. Take part in group discussions and job interviews confidently
3. Appear for placement aptitude tests confidently
4. Gain self confidence to face the placement process

### **METHODOLOGY**

The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.

## 5. Empirical Learning

Syllogism - Binary Logic [cause & effect] - Assertive & Counter Argument - Simple Interest - Time & Work - Time & Distance

Upstream & Downstream Reasoning - Verbal Comprehension I - Verbal Comprehension II - Compound Interest Logarithms - Surds & Indices

Verbal Reasoning I - Verbal Reasoning II - Verbal Reasoning III – Percentage – Test – Averages

Deductive Reasoning I - Deductive Reasoning II - Language Usage I - Decimal Fractions - Profit & Loss – Probability

Language Usage II - Logic Games I - Logic Games II – Area - Pipes & Cisterns – Test

### SCHEME OF INSTRUCTION

Marks allocated for regular participation in all oral activities in class

### SCHEME OF EXAMINATION

Complete internal evaluation on a regular Basis

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0321</b>	<b>MACHINE DYNAMICS LABORATORY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	Prerequisite				
	Nil				

### PURPOSE

To study the static and dynamic behaviour of machines.

### INSTRUCTIONAL OBJECTIVES

Students will be able to

1. Understand and use various measurement methods
2. Understand and verify the laws governing the dynamics of machines
3. Understand the case studies in the field of vibration

### LIST OF EXPERIMENTS

1. Measurement of amplitude, velocity and acceleration using vibration pick-ups.
2. Measurement of strain.
3. Measurement of cutting forces using Drill, Lathe and Milling Dynamometers.
4. Determination of moment of inertia of systems.
5. Study of gear parameters
6. Kinematics of gear trains – simple, compound, epicyclic, differential.
7. CAM Analysis – angle Vs displacement and jump phenomenon.
8. Governors - determination of characteristics and sensitivity.
9. Vibration analysis of mechanical systems.
10. Torsional vibration rotor systems.
11. Balancing of rotating masses.
12. Whirling of shaft.
13. Diagnostics and field measurement of vibrations.
14. Gyroscope.

### REFERENCE

Laboratory Manual

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0325</b>	<b>MATERIALS TECHNOLOGY LABORATORY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	Prerequisite				
	Nil				

### PURPOSE

To acquire the knowledge of identifying the metals and understanding the metallurgical concepts.

### INSTRUCTIONAL OBJECTIVES

The course will help the student to

1. Prepare different metal specimens for identification.
2. Study the microstructure of metals.
3. Understand the treatment procedures.
4. Become familiar with SEM and TEM typical microstructures.

### LIST OF EXPERIMENTS

1. Specimen preparation for metallographic examination.
2. Study of metallurgical microscope, different types and their operations.
3. Microstructural study of different materials such as Plain carbon, high carbon steels, quenched and tempered steel, Stainless steel, S.G. Iron, Malleable iron, Grey CI, White CI, Al, Brass, Bronze, Cold worked and recrystallised specimens
4. Microstructural study of steel weldment.
5. Study of Hardness values before and after heat treatment.
6. Hardenability test using Jominey end test apparatus.
7. Grain size measurement by comparison with ASTM Charts.
8. WEAR Analysis using Pin-on-Disc machine and Dry Abrasion tester.
9. Study of a typical SEM and TEM microstructures.

### REFERENCE

Laboratory Manual

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE 0321</b>	<b>AUTOMOTIVE ENGINE AND CHASSIS COMPONENTS LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	Prerequisite				
	Nil				

### PURPOSE

To provide knowledge about Automotive Engine and Chassis components.

### INSTRUCTIONAL OBJECTIVES

At the end of the course, students will be able to know

1. Different types of frames used in various automobiles.
2. Dismantling and assembling of various systems in automobile.
3. Seat layout

### LIST OF EXPERIMENTS

1. Study of Frames used for  
HMV, LMV, Car and Two Wheelers.
2. Dismantling and assembling of different types of engines
3. Dismantling and assembling of
  - a. Fuel Supply System
  - b. Steering System,
  - c. Suspension System,
  - d. Braking System,
  - e. Wheels and Tyres
  - f. Propeller Shaft, Universal Joints and Differential
4. Study of Driver Seat
5. Brake adjustment and bleeding.

### REFERENCE

Laboratory manual

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0327</b>	<b>COMPREHENSION I</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>1</b>
	Prerequisite				
	Nil				

#### **PURPOSE**

The students will be vigorously tested on the understanding of all the concepts in engineering that they have learnt so far in the Mechanical Engineering programme. This will enable the students to gain the confidence and competence to solve real life engineering problems.

#### **IMPLEMENTATION**

Class room exercises, group discussions, case studies and topics on how the things work are assigned to students on an individual basis and evaluation done by a panel of teachers. The students are required to take-up an end semester examination and obtain a minimum mark for gaining the required credit.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE0325</b>	<b>INDUSTRIAL TRAINING - I</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	Prerequisite				
	Nil				

#### **PURPOSE**

To expose the students to the industry working environment.

#### **IMPLEMENTATION**

A minimum of 2 weeks in-plant training has to be undergone by the student during winter / summer vacation following III / IV semester. A certificate from the company to the effect that he has undergone the training successfully has to be produced. The student is required to present a report on the observations and knowledge gained during the training which will be evaluated by a panel of faculty members.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE0327</b>	<b>COMPUTER SKILL</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
	Prerequisite				
	Nil				

#### **PURPOSE**

To acquire extramural knowledge on the computer implementation of various engineering solutions.

#### **IMPLEMENTATION**

The students are expected to undergo atleast two computer courses from a list of courses provided from time to time by all the departments of engineering and technology. Resources for conducting the courses will be found from in-house talents and outside professionals with expertise in the particular course. Certification will be done by both the university and the bodies drafted for the purpose.

### **SEMESTER VI**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0306</b>	<b>FLUID POWER CONTROL</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

#### **PURPOSE**

To expose the learner to the fundamentals of hydraulic and pneumatic power control and their circuits with industrial applications

#### **INSTRUCTIONAL OBJECTIVES**

To familiarize the students with

1. The fundamentals of fluid power
2. Principles and characteristics of the fluid power components
3. Circuit building and interpretation

#### 4. Logic controls and trouble shooting

### HYDRAULIC SYSTEMS

Introduction to fluid power system - Hydraulic fluids - functions, types, properties, selection and application. Construction, operation, characteristics and graphical symbols of hydraulic components – pumps, actuators/motors, valves, switches, filters, seals, fittings and other accessories.

### PNEUMATIC SYSTEMS

Introduction, comparison with hydraulic systems and electrical systems. Construction, operation, characteristics and symbols of pneumatic components. Air treatment – principles and components. Sensors – types, characteristics and applications. Introduction to fluidics and MRFL.

### HYDRAULIC / PNEUMATIC CIRCUITS

Reciprocating circuits, pressure dependant circuits, speed control circuits, pilot operated circuits, simple sequencing circuits, synchronizing circuits, circuits using accumulator, time delay circuits, logic circuits, cascading circuits, feedback control circuits.

### DESIGN OF FLUID POWER SYSTEMS

Speed, force and time calculations, Calculation of pressure and pressure drop across components, size of actuators, pumps, reservoirs and accumulators. Calculations of Heat generation in fluids.

### APPLICATION, MAINTENANCE AND TROUBLE SHOOTING

Development of hydraulic / pneumatic circuits applied to machine tools, presses, material handling systems, automotive systems, packaging industries, manufacturing automation. Maintenance in fluid power systems – preventive and breakdown. Maintenance procedures. Trouble shooting of fluid power systems – fault finding process, equipments / tools used, causes and remedies. Safety aspects involved.

### TEXT BOOKS

1. Anthony Esposito, *Fluid Power with applications*, Prentice Hall international, 1997.
2. Majumdar S.R., *Oil Hydraulics*, Tata McGraw Hill, 2002.
3. Majumdar S.R., *Pneumatic systems – principles and maintenance*, Tata McGraw-Hill, New Delhi, 1995.

### REFERENCE BOOKS

1. Werner Deppert / Kurt Stoll, *Pneumatic Application*, Vogel verlag, 1986.
2. John Pippenger, Tyler Hicks, *Industrial Hydraulics*, McGraw Hill International Edition, 1980.
3. Andrew Parr, *Hydraulics and pneumatics*, Jaico Publishing House, 2003.
4. FESTO, *Fundamentals of Pneumatics*, Vol I, II and III.
5. Hehn Anton, H., *Fluid Power Trouble Shooting*, Marcel Dekker Inc., New York, 1984.
6. Thomson, *Introduction to Fluid power*, Prentice Hall, 2004.

		L	T	P	C
AE 0302	AUTOMOTIVE ENGINE SYSTEMS	3	0	0	3
	Prerequisite				
	Nil				

### PURPOSE

The purpose of this course is to impart knowledge about automotive engine systems.

### INSTRUCTIONAL OBJECTIVES

At the end of the course, the student will be able to understand:

1. Intake and exhaust systems,
2. Carburetion and injection in engines,
3. Supercharging, turbocharging and scavenging in engines

### INTAKE AND EXHAUST

Intake system components - Discharge coefficient, Pressure drop - Air filter, intake manifold, Connecting Pipe - Exhaust system components - Exhaust manifold and exhaust pipe - Spark arresters - Exhaust mufflers, Types, operation

## **CARBURETION AND GASOLINE INJECTION**

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

Petrol injection - Open loop and closed loop systems, mono point, multi point and direct injection systems - Principles and Features, Bosch injection systems.

## **DIESEL INJECTION**

Requirements - Air and solid injection - Function of components - Jerk and distributor type pumps. Pressure waves - Injection lag - Unit injector - Mechanical and pneumatic governors - Fuel injector - Types of injection nozzle - Nozzle tests - Spray characteristics - Injection timing - Factors influencing fuel spray atomization, penetration and dispersion of diesel – pump calibration.

## **LUBRICATION AND COOLING**

Need for cooling system - Types of cooling system - Liquid cooled system: Thermosyphon system, Forced circulation system, pressure cooling system – properties of coolant, additives for coolants

Need for lubrication system - Mist lubrication system, wet sump any dry sump lubrication - Properties of lubricants, consumption of oil.

## **SUPERCHARGING AND SCAVENGING**

Objectives - Effects on engine performance - engine modification required - Thermodynamics of supercharging and Turbocharging - Turbocharging methods - Engine exhaust manifold arrangements.

Classification of scavenging systems -Mixture control through Reed valve induction - Charging Processes in two-stroke cycle engine - Terminologies - Shankey diagram - perfect displacement, perfect mixing.

## **TEXT BOOKS**

1. Ganesan V, *Internal Combustion Engines*, 2<sup>nd</sup> edition, Tata McGraw Hill Book Cop., 2003.
2. Mathur. M. L, and Sharma. R. P., *A course in Internal Combustion Engines*, Dhanpat Rai Publications Pvt.Ltd., 1998.

## **REFERENCE BOOKS**

1. Ramalingam, K. K. *Internal Combustion Engine*, Scitech Publication (India) Pvt.Ltd. 2000.
2. Domkundwar, V. M. *A course in Internal Combustion engines*, Dhanpat Rai and Co., 1999.
3. Duffy Smith, *Auto Fuel Systems*, The Good Heart Willcox Company Inc., Publishers, 1987.
4. Edward F, Obert, *Internal Combustion Engines and Air Pollution*, Intext Education Publishers, 1980.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE 0304</b>	<b>AUTOMOTIVE ELECTRICAL SYSTEMS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

## **PURPOSE**

To provide knowledge about Automotive Electrical systems.

## **INSTRUCTIONAL OBJECTIVES**

At the end of the course, students will be able to know Storage Battery, starting systems, ignition system, charging system, lighting system and accessories.

## **STORAGE BATTERY**

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

## **CHARGING SYSTEM**

Principle of generation of direct current - shunt generator characteristics, armature reaction. Third brush regulation. Cutout, Voltage and current regulators. Principle, construction and working of alternator generating systems. Bridge rectifiers. Maintenance, servicing and trouble shooting.

## STARTING SYSTEM

Condition at starting - behaviour of starter during starting. Series motor and its characteristics, Principle and construction of starter motor. Working of different starter motor drive units, Maintenance, servicing and trouble shooting. Starter switches.

## IGNITION SYSTEM

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

## LIGHTING SYSTEM AND ACCESSORIES

Earth return and insulated return systems, six volt and twelve volt systems. Fusing of circuits, low and high voltage automotive cables, wiring diagram for typical automotive wiring system, maintenance and servicing. Principle of automobile illumination, head lamp construction and wiring, horn, wind screen wiper signaling devices, fog lamps, auxiliary lighting, temperature gauge, oil pressure gauge, fuel gauge, speedometer, odometer.

## TEXT BOOK

1. Young. A. P & Griffiths. L, *Automobile Electrical and Electronic Equipments*, English Languages Book Society & New Press, 1990.
2. Kholi, P.L., *Automotive Electrical Equipment*, "Tata McGraw – Hill Co. Ltd., New Delhi, 1975.

## REFERENCE BOOKS

1. Chapman, *Principles of Electricity and electronics for the Automotive Technician*, Thomson Asia, 2000.
2. Judge. A.W., *Modern Electrical Equipment of Automobiles*, Chapman & Hall, London, 1992.
3. Vinal. G.W., *Storage Batteries*, John Wiley & Sons Inc., New York, 1985.
4. Crouse. W.H., *Automobile Electrical Equipment*, McGraw Hill Book Co. Inc., New York, 1980.
5. Robert Bosch, *Automotive Hand Book*, Bentley Publishers, 1997.
6. Nakra. C. P, *Basic Automotive Electrical Systems*, Dhanpat Rai

		L	T	P	C
AE 0306	AUTOMOTIVE TRANSMISSION	3	2	0	4
	Prerequisite				
	Nil				

## PURPOSE

To impart knowledge of automotive transmission system.

## INSTRUCTIONAL OBJECTIVES

On completion of this course,

The student will know about the clutch, gearbox, hydrodynamic drives, automatic transmission, hydrostatic drive and electric drive in automobiles, their principle of operation and performance.

## CLUTCH AND GEAR BOX

Requirements of transmission system. Different types of clutches, principle, Construction, torque capacity and design aspects. Objective of the gearbox - Determination of gear ratios for vehicles. Performance characteristics at different speeds. Different types of gearboxes - operation. Typical problems involving the above principles.

## HYDRODYNAMIC DRIVE

Fluid coupling - principle of operation, constructional details, torque capacity, performance characteristics, reduction of drag torque. Torque converter - Principle of operation, constructional details, performance characteristics, converter coupling, multistage and polyphase torque converters.

## AUTOMATIC TRANSMISSION

Ford –T model gearbox, Wilson gearbox, Cotal electromagnetic transmission, Automatic over drive, Hydraulic control system for automatic transmission.

## **AUTOMATIC TRANSMISSION APPLICATIONS**

Chevrolet Turbo glide transmission, Toyota “ECT-i” Power glides Transmission (Automatic Transmission with Intelligent Electronic control system), Mercedes Benz Automatic transmission, Hydraulic actuation system for automatic transmission system.

## **HYDROSTATIC AND ELECTRIC DRIVES**

Hydrostatic drive – principle, types, advantage and limitations. Comparison of hydrostatic drive with hydrodynamic drive. Construction and working of typical Janny hydrostatic drive.

Electric drive - Principle of early and modified Ward Leonard Control system. Advantage & limitations. Performance characteristics.

## **REFERENCE BOOKS**

1. Heldt. P. M., *Torque converters*, Chilton Book Co., 1992.
2. Newton and Steeds, *The Motor vehicle*, Illiffe Publishers, 1985.
3. Judge. A.W., *Modern Transmission systems*, Chapman and Hall Ltd., 1990.
4. SAE Transactions 900550 & 930910.
5. Crouse. W.H., Anglin. D.L, *Automotive Transmission and Power Trains construction*, McGraw Hill, 1976.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PD0302</b>	<b>PERSONALITY DEVELOPMENT VI</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>
	<b>Prerequisite</b>				
	<b>Nil</b>				

## **PURPOSE**

The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential

## **INSTRUCTIONAL OBJECTIVES**

At the end of the course, the students will be able to

1. Acquire the important soft skills for employment
2. Take part in group discussions and job interviews confidently
3. Appear for placement aptitude tests confidently
4. Gain self-confidence to face the placement process

## **METHODOLOGY**

The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students, which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.
5. Empirical Learning

Self Introduction- Narration - Current News Update – Numbers - Height & Distance - Square & Cube Roots

Current Tech Update - Verbal Aptitude Test I - GD –I - Odd man out series - Permutation & Combination - Problems on ages

GD –II - Resume Writing - Mock Interview I / reading comprehension - Problems on trains – Allegation of Mixtures – Test

Mock Interview II / reading comprehension - Mock Interview III/ reading comprehension - GD – III - Ratio & Proportion - Clocks - H.C.F & L.C.M

GD – IV - Verbal Aptitude Test II – Review – Partnership – Puzzles – Test

## **SCHEME OF INSTRUCTION**

Marks allocated for regular participation in all oral activities in class



## SCHEME OF EXAMINATION

Complete Internal evaluation on a regular Basis

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE 0322</b>	<b>VEHICLE TESTING LAB</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	Prerequisite				
	Nil				

### PURPOSE

To provide practical knowledge about Vehicle testing.

### INSTRUCTIONAL OBJECTIVES

At the end of the course, students will be able to know

1. About testing of automobiles using dynamometers and on Road
2. Engine analysis using diagnostic Systems
3. Wheel Balancing and alignment.
4. Exhaust gas analysis

### LIST OF EXPERIMENTS

1. Testing of 2 -wheeler using chassis dynamometer.
2. Testing of 4 -wheeler using chassis dynamometer.
3. Road Test of Vehicles for
  - a. Brake
  - b. Acceleration
  - c. Fuel Consumption
4. Engine Analysis using Engine Diagnostic System for
  - a. Petrol Engine.
  - b. Diesel Engine.
5. Wheel Balancing and Wheel Alignment
6. Study of Chemiluminescent NOx analyzer.
7. Measurement of HC, CO, CO<sub>2</sub>, O<sub>2</sub> using exhaust gas analyzer.
8. Diesel smoke measurement.

### REFERENCES

1. Manufacturer's Manual
2. Giles.J.G., *Vehicle Operation and performance*, Iliffe Books Ltd., London, 1989.
3. Crouse.W.H. and Anglin.D.L., *Motor Vehicle Inspection*, McGraw Hill Book Co., 1978.
4. Ganesan.V., *Internal Combustion Engines*, 2<sup>nd</sup> edition, Tata McGraw Hill Co., 2003.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE 0324</b>	<b>ENGINE AND FUEL TESTING LABORATORY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	Prerequisite				
	Nil				

### PURPOSE

This laboratory course is intended to give the students, experimental knowledge on the performance and operations of I.C. Engines.

### INSTRUCTIONAL OBJECTIVES

On completing this course, the students will get knowledge to test engines, lubricants and fuels used for IC engines. They will get the knowledge of using various dynamometers used for testing IC engines and testing of fuels.

### LIST OF EXPERIMENTS

1. a) Valve timing diagram for four stroke Engine.  
b) Port timing diagram of a two stroke Engine.
2. Performance test on constant speed diesel engine.
3. Performance study of Petrol engine at full throttle and part throttle conditions.
4. Performance study of Diesel engine at full load and part load conditions.

5. Morse test on petrol engines.
6. Optimum coolant flow rate in IC engines.
7. Energy balance test on an Automotive Diesel engine.
8. Determination of flash and fire point of fuels and lubricating oil by different methods.
9. Determination of Viscosity of Oil by different methods like, Redwood, Saybolt and Engler's Viscometer.
10. Determination of Pour and Cloud points.

## REFERENCE

Laboratory manual

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE0326</b>	<b>COMPREHENSION II</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>1</b>
	Prerequisite				
	Nil				

## PURPOSE

The students will be vigorously tested on the understanding of all the concepts in engineering that they have learnt so far in the Mechanical Engineering programme. This will enable the students gain the confidence and competence to solve real life engineering problems.

## IMPLEMENTATION

Class room exercises, group discussions, case studies and topics on how the stuff works are assigned to students on an individual basis and evaluation done by a panel of teachers. The students are required to take-up an end semester examination and obtain a minimum mark for gaining the required credit.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE0328</b>	<b>COMPUTER SKILL</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
	Prerequisite				
	Nil				

## PURPOSE

To acquire extramural knowledge on the computer implementation of various engineering solutions.

## IMPLEMENTATION

The students are expected to undergo atleast two computer courses from a list of courses provided from time to time by all the departments of engineering and technology. Resources for conducting the courses will be found from in-house talents and outside professionals with expertise in the particular course. Certification will be done by both the university and the bodies drafted for the purpose.

## SEMESTER VII

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0401</b>	<b>ECONOMICS AND PRINCIPLES OF MANAGEMENT</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

## PURPOSE

To become familiarized about Engineering Economics and Principles Management.

## INSTRUCTIONAL OBJECTIVES

The course will enable the students to become familiar with

1. The different engineering economic principles and strategies
2. Principles of organizational management
3. Behaviour of human at organizations with modern management concepts.

## ENGINEERING ECONOMICS

Introduction – Economics – Scope and Definition – Importance of Economics in Engineering - Economic optimization- Demand and Revenue Analysis – Law of Demand - Demand Forecasting –Methods of Demand Forecasting - Demand curves – Factors affecting Demand – Demand Elasticity - Production Analysis - simple problems.

## SUPPLY, COST AND OUTPUT

Supply – Supply schedule – Law of Supply – Elasticity of Supply - Cost and Supply Analysis – Types of Costs - Price and output Determination – Price Fixation – Pricing methods - Pricing Policies – Factors governing Pricing Policies – Break-Even analysis – Estimation of Break-Even Point - Usefulness of BEP – Limitations – simple problems.

## MANAGEMENT AND ITS ENVIRONMENT

Management – Definition – Functions – Evolution of Modern Management movement – Different Schools of Management - Types and Forms of Business Organization - Designing effective organizations - Individual ownership – Partnership – Joint stock companies – Cooperative enterprises – Public Sector Undertakings.

## MANAGEMENT OF HUMAN AT WORK

Human Resource Development – Motivating individuals and workgroups – Leadership for Managerial Effectiveness – Team working and Creativity – Managerial Communication – Time Management –Performance Appraisal– Career Planning.

## MODERN MANAGEMENT CONCEPTS

Management by Objectives (MBO) – Principles and Steps – Advantages and Disadvantages - Management by Exception (MBE) – Strategic management – SWOT analysis - Enterprise Resource Planning (ERP) - Supply Chain Management (SCM) – Activity Based Management (ABM).

## TEXT BOOKS

1. Murphy W. R. and Mc Kay. G., *Energy Management*, Butterworths, London.
2. Chandran, J. S., *Organizational Behaviours*, Vikas Publishing House Pvt. Ltd., New Delhi, 1994.
3. Ernest Dale, *Management Theory and Practice*, International Student Edition, McGraw Hill Publishing Co., New Delhi.

## REFERENCE BOOKS

1. Richard Pettinger, *Mastering Organizational Behaviour*, Macmillan Press, London, 2000.
2. Chaiger, N. A., *Energy Consumption and Environment*, McGraw Hill Publishing Co., New Delhi, 1981.

		L	T	P	C
ME0407	COMPUTER AIDED MANUFACTURING	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To familiarize the components of computer aided manufacturing and to introduce CNC machines and computer aided process planning.

## INSTRUCTIONAL OBJECTIVES

To familiarize the students

1. Basics of manufacturing automation
2. CNC machines and its constructional features and part programming
3. Basics of computer aided inspection
4. Automated material handling systems
5. Computer aided production planning.

## MANUFACTURING SYSTEMS AND CNC MACHINE

Manufacturing systems – types, current trends, automation in manufacturing. Group technology - part families, coding and classification - Production Flow Analysis, FMS - principle, CIM – principle. Fundamentals of CNC machines- principles of operation - features - Classification - Developments, Machining Centers.

## **ELEMENTS OF CNC MACHINE**

Interpolations - Open loop and closed loop control systems - CNC controllers - Direct Numerical Control, Adaptive Control - Machine structures, slide ways, linear bearings, Recirculating ball screws, Drives – spindle and feed drives - Feed back devices, ATC and automatic pallet system.

## **PART PROGRAMMING**

Types of part programming – Manual part programming – Fixed cycle, Subroutines, DO LOOP, MACROS, NC codes-NC programming of simple turning and milling parts, Computer Aided Part Programming - Introduction to CAM Softwares - NC Programming with interactive graphics.

## **COMPUTER AIDED INSPECTION AND HANDLING SYSTEMS**

Computer Aided Inspection and Quality Control - Non contact inspection - Computer aided testing - Automated material handling systems (conveyor, automated guided vehicle, pallets etc.) - Automated storage and retrieval systems.

## **COMPUTER AIDED PRODUCTION PLANNING AND CONTROL**

Introduction to Computer aided production planning - Application of computers - Shop floor monitoring - Materials requirement planning and Case study - Inventory control and Case study, JIT approach and Case study.

## **TEXT BOOKS**

1. Rao, P. N., Tewari N. K. and Kundra, T.K., *Computer Aided Manufacturing*, Tata McGraw-Hill, New Delhi, 2001.
2. Mikell P. Groover, Emory W. Zimmers Jr., *Computer Aided Design and Manufacturing*, Prentice Hall of India Private Ltd., New Delhi, 1996.
3. Mikell P. Groover, *Automation, Production systems and computer integrated manufacturing*, Prentice Hall of India Private Ltd., New Delhi, 2001.

## **REFERENCE BOOKS**

1. Ibrahim Zeid, *CAD/CAM Theory and Practice*, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2001.
2. James Madison, *CNC Machining Hand Book*, Industrial Press Inc., New York, 1996.
3. Barry Hawkes, *The CAD/CAM Process*, Wheeler Publishing, 1992.
4. Hans B. Kief and Frederick Waters, T., *Computer Numerical Control - A CNC Reference Guide*, Macmillan / McGraw-Hill, New York, 1992.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE 0401</b>	<b>ALTERNATIVE FUELS AND ENERGY SYSTEMS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

## **PURPOSE**

The purpose of this course is to give an overview of the fuel resources and alternative fuels and energy systems for automotive application.

## **INSTRUCTIONAL OBJECTIVES**

At the end of the course, the student will be able to understand:

1. Different types of alternative fuels for automobiles
2. Performance of alternative fuels when used in automobiles
3. Electric and solar powered vehicles

## **INTRODUCTION**

Estimation of petroleum reserves - Need for alternative fuels - Availability and Suitability to Piston Engines, Concept of conventional fuels, potential alternative fuels - Ethanol, Methanol, DEE/DME - Hydrogen, LPG, Natural gas, producer gas, Bio gas and Vegetable oils - Use in I.C. Engines-Merits and Demerits of various fuels.

## **ALCOHOL FUELS**

Properties as engine fuels - Performance in S.I.Engines - Alcohol & Gasoline blends - Flexible Fuel Vehicle - Reformed alcohols - Use in C.I. Engines - Emulsions - Dual fuel systems -Spark assisted diesel engines –

Surface ignition engines - Ignition accelerators - Combustion and emission characteristics in engines - emission characteristics.

### **GASEOUS FUELS**

Hydrogen - Properties - Use in CI Engines - Use in SI Engines - Storage methods - Safety precautions. Producer gas and biogas - Raw materials - Gasification - Properties - Cleaning up the gas - Use in SI and CI engines, LPG & Natural gas - Properties - Use in SI and CI Engines.

### **VEGETABLE OILS**

Various vegetable oils for engines – Properties - Esterification - Performance in engines - Performance and emission Characteristics

### **ELECTRIC AND SOLAR POWERED VEHICLES**

Layout of an electric vehicle - Advantage and limitations - Specifications - System component. Electronic control system - High energy and power density batteries - Hybrid vehicle - Solar powered vehicles.

### **REFERENCE BOOKS:**

1. Osamu Hirao and Richard K. Pefley, *Present and Future Automotive Fuels*, John Wiley and Sons, 1988.
2. Keith Owen and Trevor Eoley, *Automotive Fuels Handbook*, SAE Publications, 1990.
3. Richard L. Bechtold, *Automotive Fuels Guide Book*, SAE Publications, 1997.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE 0403</b>	<b>VEHICLE BODY ENGINEERING AND SAFETY</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

### **PURPOSE**

To provide knowledge about body building for automobiles.

### **INSTRUCTIONAL OBJECTIVES**

At the end of the course, students will be able to know

1. Car body details
2. Vehicle aerodynamics
3. Bus body, Commercial Vehicle details
4. Body material and mechanisms

### **CAR BODY**

Types: Saloon, Convertibles, Limousine, Estate Van, racing and sports car - Driver's seat, Body Mechanisms - window winding, Door lock, seat adjustment. Driver's visibility and tests for visibility. Minimum space requirements and methods of improving space in cars. Safety - safety design, safety equipments. Car body construction.

### **VEHICLE AERODYNAMICS**

Objectives -Vehicle drag and types - various types of forces and moments -Effects of forces and moments - Side wind effects -Various body optimization techniques for minimum drag –Wind tunnel testing: Flow visualization techniques, Scale model testing, Component balance to measure forces and moments. Simple problems.

### **BUS BODY**

Types: Mini bus, single and double decker, two level, split level and articulated bus. Bus body layout - Floor height - Engine location - Entrance and exit location - Seating dimensions. Constructional details: Frame construction, Double skin construction -Types of metal section used - Regulations -Conventional and integral type construction.

### **COMMERCIAL VEHICLE**

Types: Flat platform, drop side, fixed side, tipper body, tanker body. LCV body types: pickup, van. Dimensions of driver's seat in relation to controls and steering angle -Driver cab design.

## BODY MATERIALS, TRIM AND MECHANISMS

Aluminium alloy sheet, extrusion and casting, stainless steels, alloy steels, Metal Matrix Composites. Structural timbers -properties. Designing in GRP and high strength composites, Thermo plastics, Load bearing plastics, semi-rigid PUR foams and sandwich panel construction. Corrosion, Anticorrosion methods. Selection of paint and painting process -Body trim items.

## TEXT BOOK

1. Powloski. J., *Vehicle Body Engineering*, Business Boob Ltd., 1989

## REFERENCE BOOKS:

1. Giles. J. C., *Body construction and design*, Iliffe Boob Butterworth & Co., 1971.
2. John Fenton., *Vehicle Body layout and analysis*, Mechanical Engg Publication Ltd., London, 1982.
3. Braithwaite. J. B., *Vehicle Body building and drafting*, Heinemann Educational Book-I Ltd., London, 1977.
4. Dieter Anselm, *The Passenger Car Body*, ISBN Number: 0-7680-0708-9, SAE International, 2000.

		L	T	P	C
ME0423	COMPUTER AIDED MANUFACTURING LABORATORY	0	0	2	1
	Prerequisite				
	Nil				

## PURPOSE

To familiarize programming techniques in CNC part programming and the machining procedure in CNC machines .

## INSTRUCTIONAL OBJECTIVES

To familiarize the students in

1. Part programming for Lathe operations and milling operations
2. Canned cycles for different operations
3. Machining of components using CNC Lathe and CNC milling machine
4. CAM software.

## LIST OF EXPERIMENTS

1. Manual part programming for CNC machines using standard G and M codes.

## CNC LATHE

Part programming for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation, Combination of few operations.

## CNC MILLING MACHINE

1. Part programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling- circular, rectangular, Mirror commands.
2. Part Programming using Fixed or Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning Thread cutting.
3. Simulation of Tool Path for different operations
4. Machining of small components using CNC Lathe & CNC Milling Machine.
5. Exposure to component modeling and CL data generation using CAM software.
6. Exposure to numerical control wire-cut EDM

## REFERENCE

Laboratory Manual

		L	T	P	C
AE 0421	ENGINE RECONDITIONING LABORATORY	0	0	2	1
	Prerequisite				

## PURPOSE

To familiarize the students with repair and maintenance techniques with emphasis on practical application

**INSTRUCTIONAL OBJECTIVES**

To familiarize the students in

1. Engine Reboring and Crank shaft grinding
2. Valve repairing and refitting
3. Fuel system reconditioning

**LIST OF EXPERIMENTS**

1. Engine Reboring
2. Crank shaft grinding
3. Valve Seat grinding and Valve Lapping.
4. Silencer Decarbonising
5. Fuel Nozzle reconditioning
6. Fuel Injection Pump Calibration.

**REFERENCES**

1. Manufacturer's Manual
2. Lab Manual

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE0423</b>	<b>INDUSTRIAL TRAINING - II</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
	Prerequisite				
	Nil				

**PURPOSE**

To expose the students to the industry working environment.

**IMPLEMENTATION**

A minimum of two weeks in-plant training has to be undergone by the student during summer / winter vacation following IV / V semester. A certificate from company to the effect that he has had undergone the training successfully has to be produced after the training. The student is required to present a report on the observations and knowledge gained during the training which will be evaluated by a panel of faculty members.

**SEMESTER VIII**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE0422</b>	<b>PROJECT WORK</b>	<b>0</b>	<b>0</b>	<b>17</b>	<b>8</b>

Hardware/ Numerical /Theoretical research and development work is to be allotted. A maximum number of three students may be involved in each project. However the contribution of the individuals in the project should be clearly brought out. The combined project report is to be submitted as per the university regulations. A seminar has to be presented on the allotted topic. All the students involved in the project will be examined for their contribution.

**ELECTIVE I**

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE 0001</b>	<b>AUTOMOTIVE AERODYNAMICS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

**PURPOSE**

To Provide knowledge about Aero Dynamics aspects of automobiles.

**INSTRUCTIONAL OBJECTIVES**

Car body details, vehicle aerodynamics wind tunnels – Vehicle Handling.

**INTRODUCTION**

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

## **AERODYNAMIC DRAG OF CARS**

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.

## **SHAPE OPTIMIZATION OF CARS**

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.

The origin of forces and moments on a vehicle - side wind problems - methods to calculate forces and moments - vehicle dynamics Under side winds - the effects of forces and moments –

## **VEHICLE HANDLING**

Characteristics of forces and moments - Dirt accumulation on the vehicle - wind noise - drag reduction in commercial vehicles.

## **WIND TUNNELS FOR AUTOMOTIVE AERODYNAMIC**

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.

## **TEXT BOOK**

1. Wolf – Heinrich Hucho, *Aerodynamics of Road Vehicles*, SAE, **ISBN No:** 978-0-7680-0029-0, 1998.

## **REFERENCE BOOKS**

1. Pope. A., *Wind Tunnel Testing*, John Wiley & Sons, 2<sup>nd</sup> edition, New York, 1974.
2. Sumantran. V, Gino Sovran, *Vehicle Aerodynamics*, SAE, 1994.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE 0002</b>	<b>VEHICLE DYNAMICS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

## **PURPOSE**

To familiarize the students in Vehicle Dynamics

## **INSTRUCTIONAL OBJECTIVES**

Students will be able to

1. Know the concepts of Mechanical vibrating systems
2. Know about suspension and tyre related vibrations
3. Know about the Stability of Vehicles

## **INTRODUCTION**

Fundamental of vibration, Mechanical vibrating systems. Modelling and Simulation - Model of an automobile - Single, two, multi degrees of freedom systems – Free, forced and damped vibrations. Magnification factor - Transmissibility - Vibration absorber.

## **MULTI DEGREE OF FREEDOM SYSTEMS**

Closed coupled system - Eigen value problems - Far coupled Systems - Orthogonality of mode shapes – Modal analysis - Forced vibration by matrix inversion. Approximate methods for fundamental frequency - Dunkerley's lower bound - Rayleigh's upper bound - Hozler method for close coupled and branched systems.

## **SUSPENSION AND TYRES**

Requirements. Sprung mass frequency. Wheel hop, wheel wobble, wheel shimmy. Choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and aft directions. Ride characteristics of tyre - Effect of driving and braking torque - Gough's tyre characteristics.

## **VEHICLE HANDLING**

Over steer, under steer, steady state cornering. Effect of braking, driving torques on steering. Effect of camber, transient effects in cornering. Directional stability of vehicles.



## STABILITY OF VEHICLES

Load distribution. Calculation of Tractive effort and reactions for different drives - Stability of a vehicle on a slope, on a curve and a banked road.

## TEXT BOOK

1. Gillespie.T.D., *Fundamental of Vehicle Dynamics*, Society of Automotive Engineers, USA, 1992.

## REFERENCE BOOKS

1. Heldt.P.M. *Automotive Chassis*, Chilton Co., New York, 1992.
2. Ellis.J.R., *Vehicle Dynamics*, Business Books Ltd., London, 1991.
3. Giles.J.G. *Steering, Suspension and Tyres*, Illiffe Books Ltd, London, 1998.
4. Giri.N.K., *Automobile Mechanics*, Khanna Publishers. New Delhi, 1986.
5. Rao.J.S. & Gupta.K., *Theory and Practice of Mechanical Vibrations*, Wiley Eastern Ltd., New Delhi, 1999.

		L	T	P	C
AE 0003	COMPUTER SIMULATION OF IC ENGINE PROCESSES	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To provide knowledge about computer simulation of IC Engines Process.

## INSTRUCTIONAL OBJECTIVES

At the end of the course, students will be able to know about simulation of S.I. and CI engines.

## INTRODUCTION

Introduction - Heat of reaction - Measurement of URP - Measurement of HRP - Adiabatic flame temperature: Complete combustion in C/H/O/N 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 - Problems, SI engine simulation with adiabatic combustion, temperature drop due to fuel vapourisation, full throttle operation - efficiency calculation, part-throttle operation, super charged operation.

## PROGRESSIVE COMBUSTION

SI Engines simulation with progressive combustion with gas exchange process, Heat transfer process, friction calculation, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram and other engine performance.

## SIMULATION OF 2-STROKE SI ENGINE

Introduction – Air fuel mixture formation – Chemically correct mixture combustion – Scavenging – Exhaust and mixing processes in a two stroke engine.

## DIESEL ENGINE SIMULATION

Multi zone model for combustion, different heat transfer models, equilibrium calculations, simulation of engine performance and simulation for pollution estimation.

## TEXT BOOKS

1. Ganesan.V., *Computer Simulation of Spark - Ignition Engine Process*, Universities Press (I) Ltd, 1996.
2. Ganesan.V., *Computer Simulation of Compression - Ignition Engine Process*, Universities Press (I) Ltd, 2000.

## REFERENCE BOOKS

1. Ramoss.A.L., *Modeling of Internal Combustion Engines Processes*, McGraw Hill Publishing Co., 1992.
2. Ashley Campbel, *Thermodynamic analysis of combustion engines*, John Wiley & Sons, New York, 1986.
3. Benson.R.S., Whitehouse.N.D., *Internal Combustion Engines*, Pergamon Press, Oxford, 1979.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE 0004</b>	<b>TWO AND THREE WHEELED VEHICLES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

#### **PURPOSE**

To impart knowledge about two and three wheelers

#### **INSTRUCTIONAL OBJECTIVES**

At the end of the course, students will be able to know

1. Power unit for two and three wheelers
2. Chassis and sub-systems
3. Brakes and wheels
4. Case studies of two and three wheelers.

#### **THE POWER UNIT**

Two stroke and four stroke SI engines, merits and demerits. Symmetrical and unsymmetrical port timing diagrams. Types of scavenging processes - merits and demerits. Scavenging efficiency. Scavenging pumps. Rotary valve engine. Fuel system. Lubrication system. Magneto coil and battery coil spark ignition system. Electronic Ignition System. Starting system. Kick starter system.

#### **CHASSIS AND SUB-SYSTEMS**

Mainframe, types. Chassis and shaft drive. Single, multiple plate and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems - Shock absorbers. Panel meters and controls on handle bar.

#### **BRAKES AND WHEELS**

Drum brakes, Disc brakes, Front and rear brake links layouts. Brake adjustment. Spoked wheel, cast wheel, Disc wheel. Disc types. Tyre and tube for two and three wheelers.

#### **TWO WHEELERS**

Case study of major Indian models of scooters, motor cycles and mopeds like Bajaj, Honda, LML Scooters - Enfield, TVS Suzuki, Hero Honda, Yamaha, Kawasaki Bajaj, Honda Motor cycles - Kinetic Spark, TVS Mopeds. Servicing and maintenance.

#### **THREE WHEELERS**

Case study of Indian models. Front engine and Rear engine Auto rickshaws. Pick up van, Delivery van and Trailer.

#### **TEXT BOOK**

1. Irving.P.E., *Motor cycle Engineering*, Temple Press Book, London, 1992.

#### **REFERENCE BOOKS**

1. *The Motor Cycle Manual*, Temple Press Ltd., London, 1990.
2. Marshall Cavensih., *Encyclopedia of Motor cycling*, 20 volumes, New York and London, 1989.
3. Bryaut.R.V., *Vespa Maintenance and Repair series*.
4. Manufacturer's Manual of Various Vehicles.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE 0005</b>	<b>OFF ROAD VEHICLES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

#### **PURPOSE**

To provide knowledge about off road vehicles

#### **INSTRUCTIONAL OBJECTIVES**

At the end of the course students will be able to know

1. Classification and requirements of off road vehicles
2. Land clearing machines.

3. Earth moving machines.
4. Scrapers and graders.
5. Shovels and Ditchers.

### **CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES**

Different types and purpose - systems of engine and special features like automatic timer- turbochargers - after coolers , chassis and transmission, Multi axle vehicles.

### **LAND CLEARING MACHINES**

Power plants, chassis and transmission, Multi axle vehicles.

### **EARTH MOVING MACHINES**

Bush cutter, stumpers, Tree dozer, Rippers. Bulldozers, cable and hydraulic dozers. Crawler track, running and steering gears, scrapers, drag and self powered types - Dump trucks and dumpers - Loaders, single bucket, multi bucket and rotary types - Power and Capacity of earth moving machines.

### **SCRAPERS AND GRADERS**

Scrapers, elevating graders, self powered scrapers and graders.

### **SHOVELS AND DITCHERS**

Power shovel, revolving and stripper shovels - drag lines - ditchers - Capacity of shovels.

### **REFERENCE BOOKS**

1. Abrosimov.K. Bran Berg.A. and Katayer.K., *Road Making Machinery*, MIR Publishers, Moscow, 1971.
2. Wang.J.T., *Theory of Ground vehicles*, John Wiley & Sons, New York, 1987.
3. *Off the road wheeled and combined traction devices*, Ashgate Publishing Co. Ltd. 1998.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE 0006</b>	<b>TRACTOR AND FARM EQUIPMENTS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

### **PURPOSE**

To provide knowledge about Tractors and Farm equipments.

### **INSTRUCTIONAL OBJECTIVES**

At the end of the course, students will be able to know

1. The general design of tractors.
2. Control of the tractors and fundamentals of Engine operation.
3. Engine Frame work and Valve mechanism of Tractor.
4. Cooling system, lubrication system and Fuel system of tractors.
5. Farm equipments.

### **GENERAL DESIGN OF TRACTORS**

Classification of tractors - Different types and purpose - Main components of tractor – Safety rules.

### **CONTROL OF THE TRACTOR AND FUNDAMENTALS OF ENGINE OPERATION**

Tractor controls and the starting of the tractor engines - Basic notions and definition - Engine cycles – Operation of multi cylinder engines - General engine design - Basic engine performance characteristics.

### **ENGINE FRAME WORK AND VALVE MECHANISM OF TRACTOR**

Cylinder and pistons - Connecting rods and crankshafts - Engine balancing - Construction and operation of the valve mechanism - Valve mechanism components - Valve mechanism troubles.

### **COOLING SYSTEM, LUBRICATION SYSTEM AND FUEL SYSTEM OF A TRACTOR**

Cooling system - Classification - Liquid cooling system - Components, Lubricating system servicing and troubles - Air cleaner and turbo charger - Fuel tanks and filters - Fuel pumps.

## FARM EQUIPMENTS

Working attachment of tractors - Farm equipment - Classification - Auxiliary equipments - Trailers and body tipping mechanism.

## REFERENCE BOOKS

1. Rodichev and Rodicheva. G, *Tractor and Automobiles*, MIR Publishers, 1987.
2. Kolchin. A and Demidov. V, *Design of Automotive engines for tractor*, MIR Publishers, 1972.
3. John B Lllzedaw et-al., *Tractors and their power units*.

		L	T	P	C
AE 0007	MODERN VEHICLE TECHNOLOGY	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To impart knowledge about the latest developments in Vehicle Technology

## INSTRUCTIONAL OBJECTIVES

At the end of the course, students will be able to know

1. The recent trends in power plants
2. About suspension, Brakes, and Safety in automobiles
3. Noise and pollution in automobiles
4. Vehicle operation and control
5. Vehicle automated tracks.

## TRENDS IN POWER PLANTS

Hybrid vehicles - Stratified charged & lean burn engines - Hydrogen engines - Battery vehicles – Electric propulsion with cables - Magnetic track vehicles.

## SUSPENSION, BRAKES AND SAFETY

Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking - safety cage - air bags - crash resistance - passenger comfort

## NOISE & POLLUTION

Reduction of noise - Internal & external pollution control through alternate fuels and power plants – Catalytic converters and filters for particulate emission.

## VEHICLE OPERATION AND CONTROL

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.

## VEHICLE AUTOMATED TRACKS

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.

## REFERENCE BOOKS

1. Beranek.L.L. *Noise Reduction*, McGraw-Hill Book Co., Inc, New York, 1993.
2. *Bosch Hand book*, 3<sup>rd</sup> edition, SAE, 1993.
3. *ARAI Safety Standards 1990*.

		L	T	P	C
AE 0008	VEHICLE PERFORMANCE CHARACTERISTICS	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To provide knowledge about Vehicle Performance Characteristics.

### INSTRUCTIONAL OBJECTIVES

At the end of the course, students will be able to know and appreciate the performance curves and specifications of automobiles available in Automobile journals, and expectancy curves.

### PERFORMANCE CURVES

Resistance, power and torque curves. Driving force against vehicle speed. Acceleration and gradability in different gears for a typical car or truck plotted from specifications available in Automobile Journals.

### EXPECTANCY CURVES

Calculation and plotting the curves of Air and Rolling resistances. Driving force. Horsepower. Rear axle ratio. Engine speed. Torque and mechanical efficiency for different vehicle speeds. Pressure volume diagram. Frictional mean effective pressure. Engine capacity. Bore and stroke length. Connecting rod length to crank radius ratio. Piston velocity and acceleration against crank angle. Gas force, inertia force and resultant force against crank angle. Turning thrust on cylinder wall. Determination of gear ratios. Acceleration and gradability. Typical problems on vehicle performance.

### TEXT BOOK

1. Heldt.P.M. *High Speed Combustion Engine*, Oxford & IBH Publishing Co., Calcutta, 1989.

### REFERENCE BOOKS

1. Lichty., *IC Engines*, Kogakusha Co.Ltd., Tokyo, 1991.
2. *Automotive Engineering Journals, Auto Car, Automobile Engineer, Over Drive.*
3. Giri.N.K., *Automobile Mechanics*, Khanna Publishers, New Delhi, 1986.

## ELECTIVE II

		L	T	P	C
ME 0021	MODERN MANUFACTURING TECHNIQUES	3	0	0	3
	Prerequisite				
	Nil				

### PURPOSE

To develop the ability to understand the advanced manufacturing techniques evolved in manufacturing scenario.

### INSTRUCTIONAL OBJECTIVES

At the end of this course the student should be able to understand

1. Advanced techniques in casting
2. Recent developments in forming and powder metallurgy
3. Fabrication of micro electronic devices
4. Precision machining techniques
5. Rapid prototyping and tooling

### ADVANCES IN CASTING

Newer casting techniques-Expandable pattern casting-plaster mold and ceramic mold casting -vacuum casting, squeeze casting and semisolid metal forming-Rapid solidification for amorphous alloys-casting techniques for single crystal components.

### ADVANCED FORMING AND P/M PROCESSES

High Speed Forging machines-Die materials-Peen forming of sheet metals. Super plastic forming, forming and shaping glass. Design consideration for P/M forming-Production of metal powders-compaction-sintering-selective laser Sintering-Finishing of sintered parts- Economics of P/M forming.

### FABRICATION OF MICRO ELECTRONIC DEVICES

Semiconductors and silicon, crystal growing and wafer preparation, film deposition, oxidation, lithography, etching, metallization and testing, bonding and packing.

### PRECISION MACHINING

Precision and Micro-machining - Diamond turning of parts to nanometer accuracy-Stereo microlithography machining of microzied components.

## **RAPID PROTOTYPING AND TOOLING.**

Definition, evolution, CAD for RPT. Product design and rapid product development Fundamentals of various RPT technologies, Creation of STL or SLA file from a 3D solid model, Principles and typical processes for quick batch production of plastic and metal parts through quick tooling.

### **TEXT BOOKS**

1. Serope Kalpakjian, *Manufacturing Engineering and Technology*, Third Edition-Addison-Wesley Pub.Co, 1995.
2. Madou, M.J., *Fundamentals of micro fabrication*, CRC Press, 1997.

### **REFERENCE BOOKS**

1. Amstead, B.H., Ostwald Phylips and Bageman.R.L., *Manufacturing Processes*, John Wileys Sons,1987.
2. Jaeger, R.C., *Introduction to microelectronic Fabrication*, Addison-Wesley, 1988.
3. Chua, C.K., *Rapid Prototyping*, Wiley, 1997.
4. Hilton., P.D.,et all, *Rapid Tooling*, Marcel Dekker, 2000.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0022</b>	<b>PRECISION ENGINEERING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

### **PURPOSE**

To impart knowledge about basics of precision machining and different Manufacturing technique in precision engineering

### **INSTRUCTIONAL OBJECTIVES**

1. The basics of precision engineering
2. The various techniques of precision engineering like Nano technology etc,
3. The accuracy, influence of static stiffness, vibration accuracy etc

### **ACCURACY**

General concept of accuracy– Spindle rotation accuracy – Test methods-Displacement accuracy –Dimensional wear of cutting tools-Accuracy of NC systems-clamping errors-setting errors-Errors due to Location-location of rectangular prism, cylinder.

### **ACCEPTANCE TESTS FOR MACHINE TOOLS**

Basic type of tests – Measuring instruments used for testing machine tools-Alignment tests-Straightness, Flatness, Parallelism, Squareness, Circularity, Cylindricity.

### **INFLUENCE OF STATIC STIFFNESS, THERMAL EFFECTS**

Static stiffness – Nature of deformation in a machine tool – Overall stiffness of a lathe – Compliance of work piece-Errors due to the variation of the cutting force and total compliance – Inaccuracies due to thermal effects – Methods of decreasing thermal effects-Influence of vibration on accuracy.

### **NANOTECHNOLOGY**

Introduction-Top down and bottom up approach, Development of Nanotechnology. Precision and micro-machining, Micro EDM. Diamond turning of parts to nanometer accuracy, stereo microlithography. Carbon nanotubes-Production methods, applications. Nanomanufacturing.

### **NANOMEASURING SYSTEMS**

In-process measurement of position of processing point- post process and on line measurement of dimensional features-mechanical measuring systems- optical measuring systems-electron beam measuring systems-SEM and TEM-pattern recognition and inspection systems.

**Applications of Nanotechnology:** Nano-lithography-Photolithography- Electorn beam lithography–Ion-beam lithography-Nanocoatings -AFM applications.

### **TEXT BOOKS**

1. Murthy R.L., *Precision Engineering in Manufacturing*, New Age International, 1996.
2. Norio Taniguchi., *Nanotechnology*, Oxford university press, 1996.

## REFERENCE BOOKS

1. Lee Tong Hong, *Precision Motion control, Design and Implementation*, Springer Verlag, 2001
2. Liangchi Zhang, *Precision Machining of Advanced Materials*, Trans Tech Publications Ltd, 2001

		L	T	P	C
ME 0023	PRODUCTION MANAGEMENT	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To be acquainted with the basic aspects of Production Management.

## INSTRUCTIONAL OBJECTIVES

1. The course attempts to discuss various important planning, organizing and controlling aspects of Operations Management.
2. Through text and case studies, this course prepares for a study of different operational issues in manufacturing and services organizations.

## INTRODUCTION

History and Overview of Production Management, Capacity Planning, Location Planning- Types of Production Processes. Layout Planning- Productivity Management.

## INVENTORY MANAGEMENT

Deterministic and Probabilistic Inventory Management models, Purchasing and Warehousing, Methods Study, Motion Study and Work Measurement-simple problems.

## SCHEDULING

Job Evaluation, Wage Incentive Schemes, Value Analysis, Forecasting, Aggregate Planning- Scheduling: Gantt Charts and Sequencing-simple problems.

## MRP

Project Management with PERT/CPM-Material Requirements Planning (MRP)-Manufacturing Resources Planning (MRP II)-Enterprise Resource Planning (ERP)

## TQM

Total Quality Management-Quality management Systems, Statistical Process Control (SPC), Maintenance Management, Reliability and Maintenance, Replacement Techniques, Logistics and Supply Chain Management.

## TEXT BOOKS

1. Ahuja,K.K., *Production Management*, CBS Publishers, 1993.
2. Goel,B.S., *Production management*, Pragathi & Prakasam Publishers, 1984.

## REFERENCE BOOKS

1. Hajra Nirjhar Roy, *Production management*, MP Publishers, 1990.
2. Narang, G.B.S., & Kumar.V, *Production management*, Khanna Publishers, 1989.
3. Agarwal & Jain, *Production management*, Khanna Publishers, 1998.
4. Levin & Richard, *Production and operation management*, Tata McGraw Hill Publications, 1990.

		L	T	P	C
ME 0024	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To study the basic concepts of artificial intelligence and neural networks techniques

## INSTRUCTIONAL OBJECTIVES

To familiarize

1. Basic concepts of artificial intelligence
2. Various steps involved in artificial intelligence
3. Basic concepts of expert systems

## INTRODUCTION

History, Definition of A.I., Emulation of Human cognitive process. The knowledge search tradeoff, stored knowledge, semantic nets, An abstract view of modeling, Elementary knowledge. Computational Logic, Analysis of compound statements using simple logic connectives, predicate logic, knowledge organization and manipulation, knowledge acquisition.

## PROBLEM SOLVING AGENTS

Problem Definition - formulating Problems, Searching for Solutions, Measuring Problem, Solving Performance with Examples. Search Strategies-Uninformed or Blinded Search, Breadth First Search, Uniform Cost Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bi-directional Search, Comparing Uniformed Search Strategies. Informed Search Strategies- Heuristic Information, Hill Climbing Methods, Best-First Search, Branch-and-Bound Search, Optimal Search and A\* and Iterative Deepening A\*

## KNOWLEDGE ORGANISATION, COMMUNICATION

Matching Techniques -Need for matching, Matching problem, Partial matching, fuzzy matching, RETE matching algorithm. Knowledge organization-Indexing and Retrieval techniques, integration of knowledge in memory organization systems, Perception, Communication and Expert System. Overview of linguistics-Basic semantic Analysis and representation structures, natural language generation.

## INTRODUCTION TO PROGRAMMING LANGUAGE

Introduction to Programming Language of AI and Its Advantages, Introduction to Lisp and Its Syntax, Lisp Syntax - Numeric Function, Difference Between Lisp and Prolog, Lisp Syntax – Input Statements, Output Statements and Declaration of Local Variables, Interaction and Recursion Functions, Property List and Arrays.

## EXPERT SYSTEMS

Expert System- Introduction, Difference Between Expert System and Conventional Programs, Basic Activities of Expert System- Interpretation, Prediction, Diagnosis, Design, Planning, Monitoring, Debugging, Repair, Instruction, Control, Basic Aspect of Expert System- Acquisition Module Frames, Knowledge Base, Production Rules, Semantic Net, Inference Engine- Backward Chaining and forward Chaining. Explanatory Interface.

## TEXT BOOKS

1. Elaine Rich and Kelvin Knight, *Artificial Intelligence*, Tata McGraw Hill, New Delhi, 1991.
2. Stuart Russell and Peter Norvig, *Artificial Intelligence: A modern approach*, Prentice Hall, 1995

## REFERENCE BOOKS

1. Nilson, N.J., *Principles of Artificial Intelligence*, Springer Verlag, Berlin, 1980.
2. Patterson, *Introduction to Artificial Intelligence and Expert systems*, Prentice Hall of India, New Delhi, 1990.

		L	T	P	C
ME 0025	Process Planning and Cost Estimation	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To impart clear knowledge about process planning, costing and estimation of machining time.

## INSTRUCTIONAL OBJECTIVES

To understand the basic concepts of process planning and different methods of cost estimation in different manufacturing shops

## PROCESS PLANNING

Process Planning, selection and analysis – Manual, Experience based planning – CAPP, Variant, Generative - Processes analysis – Types of Production.

## COSTING, ESTIMATION, COSTS AND EXPENSES

Aims of costing and Estimation – Functions and Procedure – Introduction to Costs, Computing Material cost, Direct Labor cost, Analysis of Overhead costs, Factory expenses, Administrative expenses, Selling and Distributing expenses – Cost Ladder - Cost of Product - Depreciation – Analysis of Depreciation.



### ESTIMATION OF COSTS IN DIFFERENT SHOPS

Estimation in Foundry shop – Pattern cost, Casting cost - Illustrative examples. Estimation in Forging Shop – Losses in forging – Forging cost - Illustrative examples

### ESTIMATION OF COSTS IN FABRICATION SHOPS

Estimation in welding shop – Gas cutting – Electric Welding - Illustrative examples. Estimation in sheet metal shop – Shearing and Forming - Illustrative examples

### ESTIMATION OF MACHINING TIMES AND COSTS

Estimation of machining time for lathe operations - Estimation of machining time for drilling, boring, shaping, planning, milling and grinding operations - Illustrative examples

### TEXT BOOKS

1. Adithan, M. S., and Pabla., *Estimating and Costing*, Konark Publishers Pvt., Ltd, 1989.
2. Chitale, A. K., and Gupta, R.C., *Product Design and manufacturing*, Prentice Hall of India, 1997.

### REFERENCE BOOKS

1. Nanua Singh, *System Approach to Computer Integrated Design and Manufacturing*, John Wiley Inc., 1996.
2. Joseph G. Monks., *Operations Management, Theory and Problems*, McGraw Hill Book Company, 1982.
3. Narang, G.B.S., and Kumar, V., *Production and Planning*, Khanna Publishers, 1995.
4. Banga , T.R., and Sharma, S.C., *Estimating and Costing*, Khanna publishers, 1986.

		L	T	P	C
ME 0026	TOOL ENGINEERING AND DESIGN	3	0	0	3
	Prerequisite				
	Nil				

### PURPOSE

To develop in the engineering student the ability to design cutting tools and press tools for given condition.

### INSTRUCTIONAL OBJECTIVES

At the end of this course the student should be able to understand

1. Tool materials and their properties
2. Design of single point cutting tools and twist drills
3. Design of various types of dies
4. Blank development for different components
5. Design of jigs and fixtures for simple components

### TOOL DESIGN

Different tool materials- cemented carbides, coated carbides, cermets, ceramics and polycrystalline tool materials - compositions-properties of tool materials-selection and treatments, Plastics as tooling materials , new tooling materials. Design of single point turning and threading tools- Selection of tool holders and inserts for turning- chip breakers. Design of twist drill and reamers.

### PRESS TOOL DESIGN

Press working terminology- presses and press accessories- computation of capacities and tonnage requirements-strip layout-Types of dies – design and development of various types of cutting, forming, bending and drawing dies, progressive dies, combination dies and compound dies - Blank development for cylindrical and non cylindrical shells, simple problems.

### DESIGN OF JIGS

Principles of jigs and fixtures- locating elements- Drill bushes- Different types of jigs-plate, latch, channel, post, angle plate , turn over, and pot jigs- automatic drill jigs, Design and development of jigs for given components.

### DESIGN OF FIXTURES

Design principles of fixtures, design of fixtures for milling, boring. Design of fixture for assembly, inspection and welding. Design and development of fixtures for given components.

## TERM PROJECT

Submission of an industrial report on observation training in Jigs, fixture and press tools. ( A group comprising of 3 or 4 students should identify a component from an industry and should design jig and fixture or press tool as per the requirement ).

## TEXT BOOKS

1. Sadasivan,T.A., and Sarathy,D., *Cutting tools for Productive machining* , 1<sup>st</sup> edition, Widia (India) Ltd, Bangalore,1999..
2. Donaldson,C., Lecain.G.H. and Goold,V.C., *Tool Design*, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2002.
3. Edward G. Hoffman., *Jigs and Fixture design*, 2<sup>nd</sup> edition, Galgotia publication Pvt. Ltd., New Delhi, 1987.

## REFERENCE BOOKS

1. Hiram E. Grant, *Jigs and Fixtures - Non standard clamping device*, Tata McGraw Hill, New Delhi, 1971.
2. Prakash H Joshi., *Press tool design and construction*, 1<sup>st</sup> edition, Wheeler Publishing, New Delhi, 2000.
3. Kempster, M.H.A., *An Introduction to Jig and tool design*, 3<sup>rd</sup> edition , ELBS, 1987.
4. Prakash H Joshi., *Cutting tools*, 1<sup>st</sup> edition, Wheeler Publishing, New Delhi, 1997
5. Prakash H Joshi., *Tooling Data*, 1<sup>st</sup> edition, Wheeler Publishing, New Delhi, 2000.
6. ASTME, *Fundamentals of Tool design*, 11<sup>th</sup> edition, PHI, New Delhi, 1987.

		L	T	P	C
ME 0027	FLEXIBLE MANUFACTURING SYSTEMS	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To provide the knowledge about different manufacturing concepts like GT and FMS.

## INSTRUCTIONAL OBJECTIVES

1. Study of different types of production
2. Knowledge of group technology(GT)
3. Introduction and need of FMS
4. Detailed study of flexible manufacturing cells and systems
5. FMS software

## PRODUCTION SYSTEMS

Types of production-Job Shop, Batch & Mass production-Functions in Manufacturing-Organization and Information Processing in Manufacturing-Plant Layout-Batch production – Work in Progress inventory, Scheduling, Problems.

## GROUP TECHNOLOGY

Formation of Part Families - Part Classification - Coding Systems-Optiz, Multi Class - Production Flow Analysis – Machine Cells Design -Clustering Methods-Modern Algorithms- Benefits of GT-system planning-objective, guide line, system definition and sizing-human resources-objective, staffing, supervisor role.

## FLEXIBLE MANUFACTURING SYSTEMS

Introduction-Evolution-Definition-Need for FMS-Need for Flexibility-Economic Justification of FMS-Application Criteria-Machine tool Selection & Layout-Computer Control System-Data files-Reports-Planning the FMS-Analysis Methods For FMS- Benefits and Limitations.

## FLEXIBLE MANUFACTURING CELLS

Introduction-Cell Description and Classifications-Unattended Machining–Component Handling &storage system-cellular versus FMS-System- simulation, hardware configuration- Controllers, Communication networks- Lean production and agile manufacturing.

## FMS SOFTWARE

Introduction-General Structure and Requirements-Functional Descriptions-Operational Overview-Computer Simulation- FMS installation-Objective, Acceptance testing, Performance goals, Expectations, Continued support.

## TEXT BOOKS

1. William W.Luggen, *Flexible Manufacturing Cells and Systems*, Prentice Hall, NJ, 1991.
2. Mikell P.Groover, *Automation Production Systems & Computer Integrated manufacturing*, PHI, 1989.

## REFERENCE BOOKS

1. David J.Parrish, *Flexible Manufacturing*, Butterworth-Heinemann, 1990.
2. Buffa, E.S., *Modern Production and Operation Management*, 1985.

		L	T	P	C
ME 0028	NON TRADITIONAL MACHINING TECHNIQUES	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To impart clear knowledge about different unconventional processes and the latest developments to the students.

## INSTRUCTIONAL OBJECTIVES

To enable the students to understand the basic concepts of non traditional machining techniques, factors influencing the processes and their applications

## INTRODUCTION

Introduction to Non Traditional machining methods – Need for Non Traditional machining - Sources of metal removal – classification on the basis of energy sources – Parameters influencing selection of process.

## MECHANICAL ENERGY TECHNIQUES

**Abrasive Jet Machining (AJM):** Operating principles – Equipment – Parameters influencing metal removal – Benefits – Applications – Advantages and Limitations.

**Water Jet Machining (WJM):** Operating principles – Equipment – Parameters influencing metal removal – Benefits – Applications – Advantages and Limitations.

**Ultra Sonic Machining (USM):** Operating principles – Equipment and sub systems – Parameters influencing metal removal – Benefits and Applications – Advantages and Limitations

## ELECTRICAL ENERGY TECHNIQUES

**Electro Chemical Machining (ECM):** Operating principles – Equipment and sub systems – Parameters influencing metal removal – Benefits and Applications – Advantages and Limitations – current developments in ECM.

**Electro Chemical Grinding (ECG):** Operating principles – Equipment and sub systems – Parameters influencing metal removal – Benefits – Applications – Advantages and Limitations

## THERMO ELECTRICAL ENERGY TECHNIQUES

**Electrical Discharge Machining (EDM) and Wire Cut Electrical Discharge Machining (WCEDM):** Operating principles – Equipment and sub systems – Parameters influencing metal removal – Benefits – Applications – Advantages and Limitations.

**Electrical Discharge Grinding (EDG):** Operating principles – Equipment and sub systems – Parameters influencing metal removal – Benefits – Applications – Advantages and Limitations

## THERMAL ENERGY TECHNIQUES

Operating principles – Equipment and sub systems – Parameters influencing metal removal – Benefits – Applications – Advantages and Limitations of Electron Beam Machining (EBM), Plasma ARC Machining (PAM) and Laser BEAM Machining (LBM).

## TEXT BOOK

1. Mishra. P.K., *Non-Conventional Machining*, The Institute of Engineers(India), Text Book Series , 1997.

## REFERENCE BOOKS

1. Bennedict, G.F., *Non Traditional Machining Techniques*, Marcel Decker, 1990.
2. Sharma, P.C., *A Text book of Production Engineering*, 1995
3. Pandey and Sha, *Modern Manufacturing Process*, Prentice Hall,

		L	T	P	C
ME 0029	FOUNDRY ENGINEERING	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To impart the students clear knowledge about foundry engineering.

## INSTRUCTIONAL OBJECTIVES

To understand the Basic concepts of

1. Patterns and pattern making
2. Different methods of moulding, casting processes
3. Modernization of foundry shop.

## PATTERNS AND PATTERN MAKING

Introduction to Foundry – Steps involved in casting, advantages, limitations and applications of casting processes. Pattern types, allowances for pattern, pattern materials colour coding and storing of patterns.

## MOULDING

Moulding methods and process – materials, equipment moulding, sand ingredients, essential requirements, sand preparation and control testing, cores and core making.

Design considerations in casting gating and Riser and Directional solidification in castings.

## CASTING PROCESS

Sand casting – pressure die casting – Permanent mould casting – Centrifugal casting – Precision investment casting – shell moulding – CO<sub>2</sub> moulding, continuous casting – squeeze casting – electroslag casting – Fettling and finishing – Defects in castings – Near Net Techniques.

## MELTING, POURING AND TESTING

Foundry remelting furnaces – selection of furnaces – crucible oil fired furnaces – electric furnaces – cupola furnace, calculation of cupola charges – Hot blast cupola – Degasification – Inoculation – Pouring equipment – Inspection of castings.

## MODERNIZATION AND MECHANIZATION IN FOUNDRY SHOP

Need – Areas for mechanization – Typical lay out – sand reclamation techniques – material handling, pollution control in foundry shop – Computers in castings.

## TEXT BOOKS

1. Banga T.R., and Agarwal R.L., *Foundry Engineering*, Khanna publishers, 1992.
2. Jain.P.L., *Principles of Foundry Technology*, Dhanpat Rai and sons, 1996.

## REFERENCE BOOKS

1. Taylor H.F. Flemings .M.C and Wulff. J, *Foundry Engineering*, Wiley Eastern Ltd., 1993.
2. Gupta.R.B, *Foundry Engineering*, Sathyaparkasam, 1989.
3. *ASM Metals Hand Book on Castings*, Vol. 15, 14<sup>th</sup> Edition, 2002.

## ELECTIVE III

		L	T	P	C
ME 0041	COMBUSTION ENGINEERING	3	0	0	3
	Prerequisite				
	Nil				

## COMBUSTION OF FUELS

Combustion equations, Theoretical air, excess air, air fuel ratio, equivalence ratio, exhaust gas composition, Airfuel ratio from exhaust gas composition, heating value of fuels.

## **THERMODYNAMICS OF COMBUSTION**

Thermo-chemistry, First law analysis of reacting systems, Adiabatic combustion temperature, Second law analysis of reacting systems, criterion for chemical equilibrium, Equilibrium constant for gaseous mixtures, Evaluation of equilibrium composition, chemical availability.

## **KINETICS OF COMBUSTION**

Rates of reaction, Reaction order and molecularity complex reactions, chain reactions, Arrhenius rate equation, Collection theory, activated complex theory, Explosive and general oxidative characteristics of fueled.

## **FLAMES**

Laminar and Turbulent flames, Premixed and Diffusion flames, Burning velocity and its determination, Factors affecting burning velocity, Quenching, Flammability and Ignition, Flame stabilization in open burners.

## **ENGINE COMBUSTION**

Combustion in SI and CI engines, stages of combustion in SI and CI engines, Normal combustion and Abnormal combustion, Emissions from premixed combustion, Emission from Non premixed combustion, Control of emissions

## **TEXT BOOK**

1. Stephen R. Turns, *An Introduction to Combustion*, McGraw Hill Book Company, 1996.

## **REFERENCE BOOKS**

1. Irwin Glassman, *Combustion*, Third Edition, Academic Press, 1996.
2. Sharma. S. P and Chandramohan, *Fuels and Combustion*, Tata McGraw Hill Book Co., 1984.
3. Samir Sarkar, *Fuels and Combustion*, Orient Longman, 1984.
4. Kuo. K. K, *Principles of Combustion*, John Wiley & Sons, 1984.
5. Heywood. J. B, *Internal Combustion Engine Fundamentals*, McGraw Hill Book Co., 1988.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0042</b>	<b>GAS TURBINE TECHNOLOGY</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

## **PURPOSE**

To familiar various working principle of Gas Turbine Power plant.

## **INSTRUCTIONAL OBJECTIVES**

1. To study basic equation of power cycles
2. To study flow through centrifugal compressor and axial flow compressor
3. To study flow through Turbines and combustion systems
4. To study flow through Performance predictions

## **INTRODUCTION**

Open cycle single shaft and twin shaft multi speed arrangement – closed cycle – aircraft propulsion – industrial application – environmental issues future – possibilities

## **POWER CYCLES**

Ideal cycles method of accounting – component losses – design point performance calculations – comparative performance of practical cycles – combined cycle – cogeneration schemes – closed cycle - gas turbine - reheat – intercooling – regenerator cycles.

## **CENTRIFUGAL AND AXIAL FLOW COMPRESSORS**

Centrifugal compressor – principle of operation – work done – pressure rise – the diffuser – compressibility effects – non dimensional quantities computerized design procedure. Axial flow compressor basic operation – elementary theory – factors effecting stage pre ratio – blockage in compressor annulus – degree of reaction – blade fixing details -sealing materials – material selection for compressor blades – stage performance – design and off design – performance characteristics.

## TURBINES AND COMBUSTION SYSTEMS

Operation requirements, type of combustion – factors affecting combustion process – combustion chamber performance.

Turbine – construction – performance – impeller blade fixing – cooling of turbine blades – blade vibration – protective coating – gas turbine turbo chargers- power expanders – Vortex theory – estimation of stage performance.

## PERFORMANCE PREDICTIONS

Prediction and performance of gas turbines component characteristics – off design operation – equilibrium running of gas generator – off design operation of free turbine – methods of displacing of the equilibrium running line – incorporation of variable pressure losses – matching procedure for two spool engines – principle of control systems.

## TEXT BOOK

1. Cohen – HEFC Rogers and HW Saravanamutto, *Gas turbine theory*, Long Man Scientific Technical Singapore 1997

## REFERENCE BOOKS

1. Horlock JH, *Axial flow turbine*, Butterworth Publishers
2. Gopalakrishnan G & Prithvi Raj D, *Treatise on Turbomachines*, Scitech Publications, Chennai 2002

		L	T	P	C
ME 0044	FUEL CELL TECHNOLOGY	3	0	0	3
	Prerequisite				
	(permission from teacher)				

## PURPOSE

To introduce the technology of fuel cells and to familiarize with the research and developmental challenges in fuel cell technology.

## INSTRUCTIONAL OBJECTIVES

At the end of the course, the student will be able to:

1. Understand the basic principles involved fuel cell operation,
2. Have knowledge of various fuel cells and their specific operating principles,
3. Design simple fuel cell systems, and
4. Get exposed to research and development challenges involved in various types of fuel cells.

## INTRODUCTION AND THERMODYNAMICS

**Introduction:** Basic operating principles – Historical highlights – Classification. **Thermodynamics:** Electrochemical energy conversion – Theoretical efficiency – Electrochemical energy conversion – Factors affecting electrochemical energy conversion

## ELECTRODE KINETICS

Electrode double layer – Electrolyte double layer – Double layer models (Helmoltz model, Gouy-Chapman Model, Stern model, Grahame model – Bockris, Devenathan and Muller model, and chemical models) – Solid metallic electrode – Semiconductor electrode – Specific adsorption – Zero potential.

## ALKALINE FUEL CELLS & PHOSPHORIC ACID FUEL CELLS

**Alkaline Fuel Cells:** Working principle – Components – Modules and stacks – Performance characteristics (power density, space applications, atmospheric pressure cells) – Limitations and R&D challenges – System issues – Ammonia as fuel. **Phosphoric Acid Fuel Cells:** Cell reactions – Electrodes (stability of catalysts, electrode fabrication – fuel cell performance) – Stacks and systems.

## SOLID OXIDE FUEL CELLS & MOLTEN CARBONATE FUEL CELLS

**Solid Oxide Fuel Cell:** Principle of operation - Benefits and limitations – Cell components (electrolytes, zirconia systems, ceria based electrolytes, perovskite-based systems) – Cathode materials – Anode materials – Interconnects – Fuel reactions – Configurations and performance (tubular, monolithic, planar) – Environmental impact – Applications. **Molten Carbonate Fuel Cell:** General principle – Components (electrolyte and matrix, cathode and anode materials) – Electrode reactions – Life time

## **DIRECT METHANOL FUEL CELLS & PROTON EXCHANGE MEMBRANE FUEL CELLS**

**Direct Methanol Fuel Cells:** Operating principle – Noble metal issue – Electro-oxidation of methanol (catalysts, oxygen electro-reduction, electrolyte, non-catalytic aspects) – Methanol crossover – Catalyst optimization – Vapor feed versus liquid feed cells. **Proton Exchange Membrane Fuel Cells:** Operating principle (membranes, electrodes and electrolysis, optimization of membrane and electrode assembly, impurities) – Technology development (single cell and stacks, composite plates) – Fuel processing – Modeling studies (membrane, electrode, membrane-electrode assembly, fuel cell, stack and system) – Technology development and applications.

### **TEXT BOOKS**

1. Viswanathan, B. and Aulice Scibioh, M., *Fuel Cells Principles and Applications*, Universities Press (India) Pvt. Ltd., Hyderabad, 2006.
2. Hoogers, G., Edr., *Fuel Cell Technology Handbook*, CRC Press, Washington D. C., 2003.

### **REFERENCE BOOKS**

1. Larminie, J. and Dicks, A., *Fuel Cell Systems Explained*, John Wiley & Sons, Ltd., New York, 2001.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0047</b>	<b>REFRIGERATION AND AIR CONDITIONING SYSTEMS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

### **PURPOSE**

This course provides the knowledge about refrigeration and air conditioning system, and enables them to do simple design calculations and analysis of these systems

### **INSTRUCTIONAL OBJECTIVES**

Vapour compression and vapour absorption system operation, cycle analysis and method for improving performance, various components of refrigeration systems, design of air conditioning systems by cooling load calculations, application of refrigeration and air conditioning systems.

### **VAPOUR COMPRESSION REFRIGERATION SYSTEMS**

Review of thermodynamic principles of refrigeration-Simple vapour compression system – analysis-Method for improving COP – Multistage and multiple evaporator system, cascade system – COP comparison.

### **ABSORPTION REFRIGERATION SYSTEMS**

Absorption refrigeration cycle-water lithium bromide systems – ammonia absorption refrigeration system – COP calculation of single effect absorption system – Refrigeration absorbent combinations-comparison of absorption system with vapour compression systems

### **REFRIGERATION EQUIPMENTS & CONTROL**

Compressors – Condensers and Cooling towers – Evaporators - Expansion devices. Refrigerants-: properties – selection of refrigerants-alternate refrigerants. Refrigeration plant controls- Testing & charging of refrigeration units.

### **DESIGN OF AIR CONDITIONING SYSTEMS**

Different heat sources-conduction and radiation load-occupants load-equipment load-fresh air load-infiltration-air load- estimation of total load, bypass factor consideration-effective sensible heat factor (ESHF)-cooling coils and dehumidifier air washers.

### **APPLICATION OF REFRIGERATION AND AIR CONDITIONING SYSTEMS**

Preservation of different products-ice factory-dairy plant refrigeration systems-Air conditioning of hotels and restaurants-air conditioning of theatres and auditorium-air conditioning of hospitals.

### **TEST BOOK**

1. Arora S.C., Domkundwar S., *A course in Refrigeration and Air conditioning*, Dhanpat Rai & Co, (P) Ltd., 1997.

### **REFERENCE BOOKS**

1. Manohar Prasad, *Refrigeration and Air conditioning*, New Age International (P) Ltd, 1999.
2. Stoecker W.F. and Jones J.W. *Refrigeration and Air Conditioning*, Tata McGraw Hill, 1986.

- Roy J.Dossat, *Principles of Refrigeration*, Pearson Education Asia, Fourth edition 2001.
- Arora C.P, *Refrigeration and Air Conditioning*, Tata McGraw Hill,2002.

		L	T	P	C
<b>ME 0048</b>	<b>ALTERNATIVE SOURCES OF ENERGY</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

#### PURPOSE

To familiarize the students with the concept of Biomass, Solar Energy, Wind Energy OTEC, Fuel cells and MHD systems.

#### INSTRUCTIONAL OBJECTIVES

To analyse the various renewable energy sources like wind, solar, biomass, Ocean energy, Fuel cells and MHD systems. Exposure on biomass gasification and combustion, Theory of flat plate collectors, photo voltaic, thermal applications and limitations of solar energy are also provided.

#### BIOMASS

Biomass, sources of biomass, fermentation, pyrolysis, gasification and combustion, biogas, calorific value, power generation, biogas plant design and operation. Thermo-chemical conversion of biomass, Energy balance, conversion to solid, liquid, and gaseous fuel.

#### SOLAR ENERGY

Solar radiation and its measurements. Flat plate collectors, Photovoltaic and thermal applications, limitation of solar energy. Theory of flat plate collectors. Solar water heating, solar drying, solar stills, solar cooling and refrigeration.

#### WIND ENERGY

Basic principle of Wind energy conversion – Wind data and Energy Estimation – Site selection considerations – components of WECS – Advantages and disadvantages of WECS – Design consideration of horizontal axis Machines – Analysis of aerodynamic forces acting on the blade – Performance of wind Machines.

#### OCEAN ENERGY

Ocean Thermal Energy Conversion, wave and tidal energy, availability, geographical distribution power generation using OTEC, scope and economics, geothermal energy, availability.

#### FUEL CELL AND MHD SYSTEMS

Fuel cell – principle – types – Advantages and disadvantages – conversion efficiency – application.

MHD - Power Generation Principle – Open cycle and Closed cycle – Design problems and developments – Advantages.

#### TEXT BOOKS

- Rai G.D., *Non-Conventional Energy Sources*, Khanna Publishers, 4th edition, 2005.

#### REFERENCE BOOKS

- Wakil M.M.EL, *Power Plant Technology*, McGraw Hill Book Company, 1984
- Soreyson B, *Renewable Energy*, Academic Press, 1989.
- Twidell J.W. and Weir A.D. *Renewable Energy Resources*, ELBS Publication, 1986.

		L	T	P	C
<b>AE 0009</b>	<b>AUTOMOTIVE AIR CONDITIONING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

#### PURPOSE

To familiarize the students with the fundamentals of automobile air conditioning, heating systems, refrigerants, trouble shooting and service.

#### INSTRUCTIONAL OBJECTIVES

Students will be able to



1. Know the concepts of Air conditioning and heating.
2. Know about conventional and modern refrigerants for automotive applications.
3. Know about air control, handling, trouble shooting and servicing.

### **AIRCONDITIONING FUNDAMENTALS**

Basic air conditioning system - Location of air conditioning components in a car - Schematic layout of a refrigeration system. Compressor components - Condenser and high pressure service ports. Thermostatic expansion valve - Expansion valve calibration - Controlling evaporator temperature - Evaporator pressure regulator - Evaporator temperature regulator.

### **AIR CONDITIONER - HEATING SYSTEM**

Automotive heaters - Manually controlled air conditioner - Heater system - Ford automatically controlled air conditioner and heater systems - Automatic temperature control - Air conditioning protection – Engine protection.

### **REFRIGERANTS**

Refrigerant Classification, Designation, Alternate Refrigerants, Global Warming Potential & Ozone Depleting Potential aspects. Handling refrigerants

### **AIR ROUTING & TEMPERATURE CONTROL**

Objectives - Evaporator care airflow through the Dash recirculation unit - Automatic temperature control – Duct system - Controlling flow - Vacuum reserve - Testing the air control and handling systems.

### **TROUBLE SHOOTING AND SERVICE**

Causes of air conditioner failure - Trouble shooting of air controlling system - Air conditioner maintenance and service - Servicing heater system. Removing and replacing components – leak testing - Compressor service.

### **TEXT BOOK:**

1. William H Crouse and Donald L Anglin, *Automotive Air conditioning*, McGraw-Hill Inc., 1990.

### **REFERENCE BOOKS**

1. Dwiggins, *Automotive Air Conditioning*, Thomson Asia, 2002
2. Mitchell information Services, Inc., *Mitchell Automatic Heating and Air Conditioning Systems*, Prentice Hall Ind., 1989.
3. Paul Weiser, *Automotive Air Conditioning*, Reston Publishing Co Inc., 1990.
4. MacDonald.K.L, *Automotive Air Conditioning*, Theodore Audel series, 1978.
5. Goings. L.F., *Automotive Air Conditioning*, American Technical services, 1974.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>AE 0010</b>	<b>AUTOMOTIVE POLLUTION AND CONTROL</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

### **PURPOSE**

To provide knowledge about Automotive Pollution and control Techniques

### **INSTRUCTIONAL OBJECTIVES**

At the end of the course, students will be able to understand

1. Mechanism of pollutant formation in engines
2. Treatment and Control Techniques
3. Pollution measurements
4. Laws and Regulation related to automotive Emission Levels.

### **MECHANISM OF POLLUTANT FORMATION IN ENGINES**

Introduction, Pollutants, sources, formation of HC and CO in SI engines, NO formation in SI and CI engines, Particulate emission from SI and CI engines, Smoke Emission in CI engines. Effect of operating variables on emission formation.

## POST COMBUSTION TREATMENTS

Introduction, physical conditions and exhaust gas compositions before treatment, catalytic mechanism. Thermal reactions, installation of catalyst in exhaust lines, NOx treatment in diesel engines. Diesel trap oxidizers

## CONTROL TECHNIQUES

Pollution control in SI and CI engines, design changes, optimization of operating factors, exhaust gas recirculation, fuel additives to reduce smoke and particulates.

## INSTRUMENTATION FOR POLLUTION MEASUREMENTS

NDIR analyzers, thermal conductivity and flame ionization detections, analyzers for NOx, gas chromatograph, Orsat apparatus, smoke meters - spot sampling and continuous indication types like Bosch, Hartridge.

## LAWS AND REGULATION

Historical background, regulatory test procedures (European cycles), exhaust gas pollutants (European railroad limits), particulate pollutants, European statutory values, inspection of vehicles in circulation (influence of actual traffic conditions and influence of vehicle maintenance) Indian Emission Standards.

## TEXT BOOKS

1. Springer and Patterson, *Engine Emission*, Plenum Press, 1990.
2. W.M. Crouse and A.L. Anglinm, *Automotive emission control*, McGraw Hill Co., New York 1993.

## REFERENCE BOOKS

1. Ganesan.V., *Internal Combustion Engines*, 2<sup>nd</sup> edition, Tata McGraw Hill Co, 2003.
2. Obert.E.F., *Internal Combustion Engines*, Harper and Row, 1982.
3. Taylor.C.F., *Internal Combustion Engines*, MIT Press, 1972.
4. Heywood.J.B., *Internal Combustion Engine Fundamentals*, McGraw Hill Book Co., 1995.

## ELECTIVE IV

		L	T	P	C
AE 0011	MICROPROCESSOR APPLICATION IN AUTOMOBILES	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To provide knowledge about microprocessor application in automobiles

## INSTRUCTIONAL OBJECTIVES

At the end of the course, students will be able to know

1. Microprocessor fundamentals
2. Assembly language programming
3. Data transfer schemes and Interfacing devices.
4. Applications of microprocessors for automobiles

## MICROPROCESSOR FUNDAMENTALS

Architecture, functions and pin details of 8085 Microprocessor. Instruction format - addressing modes - instruction set of 8085 MPU-T-STATE - Machine cycle and instruction cycles - Timing diagrams

## ASSEMBLY LANGUAGE PROGRAMMING

Construct of the language programming - Assembly format of 8085 - Assembly Directive - Multiple precision addition and subtraction - BCD to Binary and Binary to BCD, Multiplication, Division, Code conversion using look up tables - Stack and subroutines.

## DATA TRANSFER SCHEMES

Interrupt structure - Programmed I/O - Interrupt driven I/O, DMA - Serial I/O.

## INTERFACING DEVICES

Types of interfacing devices - Input / Output ports 8212, 8255, 8251, 8279. Octal latches and tristate buffers - A/D and D/A converters - Switches, LED's ROM and RAM interfacing.

## APPLICATIONS

Data acquisitions - Temperature control - Stepper motor control - Automotive applications Engine control, Suspension system control, Driver information systems, Development of a high speed, high precision learning control system for the engine control.

## TEXT BOOK

1. Ramesh, S. Goankar., *Microprocessor Architecture, Programming and Applications with 8085*, Penram International Publishing (India), New Delhi, 1986.

## REFERENCE BOOKS

1. Douglas V.Hall, *Microprocessor and Interfacing – Programming and Hardware*, Tata McGraw-Hill Publishing Co Ltd., New Delhi, 1991.
2. Aditya.P.Mathur, *Introduction to Microprocessors*, 3<sup>rd</sup> Edition, Tata McGraw-Hill Publishing Co Ltd., New Delhi, 1989.
3. Ahson.S.I., *Microprocessors with Applications in Process Control*, Tata McGraw-Hill, New Delhi, 1986.
4. L.Bianco and A.Labella., *Automotive Micro Electronics*, Elsevier Science Publishers. 1986.

		L	T	P	C
AE 0012	AUTOMOTIVE ELECTRONICS	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To provide knowledge about application of electronics in Automobile engineering

## INSTRUCTIONAL OBJECTIVES

At the end of the course, students will be able to know

1. Fundamentals of automotive electronics
2. Sensors and actuators for various engine applications
3. Electronic fuel injection and ignition systems
4. Automobile control system
5. Electronics application to security and warning systems

## FUNDAMENTAL OF AUTOMOTIVE ELECTRONICS

Current trend in Automobiles - Open loop and closed loop systems - Components for electronic engine management. Electronic management of chassis system.

## SENSORS AND ACTUATORS

Introduction, basic sensor arrangement, types of sensors such as -oxygen sensors, Crank angle position sensors - Fuel metering, vehicle speed sensor and detonation sensor -Altitude sensor, flow sensor. Throttle position sensors, solenoids, stepper motors, relays.

## ELECTRONIC FUEL INJECTION AND IGNITION SYSTEMS

Introduction, Feed back carburetor systems (FBC), Throttle body injection and multi point fuel injection, Fuel injection systems, injection system controls. Advantages of electronic ignition system. Types of solid-state ignition systems and their principle of operation, Contact less electronic ignition system, Electronic spark timing control.

## DIGITAL ENGINE CONTROL SYSTEM

Open loop and closed loop control systems -Engine cranking and warm up control -Acceleration enrichment - Deceleration leaning and idle speed control. Distributor less ignition -Integrated engine control system, Exhaust emission control engineering.

## VEHICLE MOTION CONTROL AND STABILIZATION SYSTEMS

Vehicle motion control - Adaptive cruise control, Electronic transmission control. Vehicle stabilization system - Antilock braking system, Traction control system, Electronic stability program. Onboard diagnosis system.

## TEXT BOOKS

1. William B. Ribbens, *Understanding Automotive Electronics*, 5<sup>th</sup> Edition, Butterworth, Heinemann Woburn, 1998.

2. Tom Weather Jr and Cland C.Hunter, *Automotive Computers and Control system*, Prentice Hall Inc., New Jersey.
3. BOSCH, *Automotive Handbook*, 6<sup>th</sup> Edition, Bentley publishers.

#### REFERENCE BOOKS

1. Young, A.P. and Griffiths.L, *Automobile Electrical Equipment*, English Language Book Society and New Press.
2. Crouse.W.H., *Automobile Electrical equipment*, McGraw Hill Book Co Inc., New York, 1955.
3. Robert N Brady., *Automotive Computers and Digital Instrumentation*, A Reston Book, Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
4. Bechtold., *Understanding Automotive Electronics*, SAE, 1998.

		L	T	P	C
<b>IC0461</b>	<b>INSTRUMENTATION AND CONTROL</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

#### PURPOSE

To enable the students to understand the fundamentals of Instrumentation and control available for monitoring/measuring in domestic / industrial applications.

#### INSTRUCTIONAL OBJECTIVES

At the conclusion of this course, the students will be able to:

1. To learn fundamentals of various types of transducers
2. To acquire basic understanding of principle & working of transducers
3. To understand the methods to analyze the stability of systems from transfer function forms.

#### MEASUREMENT OF FORCE, TORQUE AND VELOCITY

Electric balance – different types of load cells – magnets – elastics load cell – strain gauge load cell – different methods of torque measurement Strain gauge, relative regular twist- speed measurement – revolution counter – capacitive tacho – drag up type tacho – D.C and A.C. tacho generators – stroboscope.

#### MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY

Accelerometers – LVDT, piezo-electric, strain gauge and variable reluctance type accelerometers – mechanical type vibration instruments seismic instruments as an accelerometer and vibrometer – calibration of vibration pick ups – units of density, specific gravity and viscosity used in industries – pressure head type densitometer – float type densitometer – ultrasonic densitometer

#### MEASUREMENT OF PRESSURE & TEMPERATURE

Units of pressure –manometers – different types – elastic type pressure gauges – Bourdon tube bellows – diaphragms – Electrical methods – elastic elements with LVDT and strain gauges – measurement of vacuum – different types- McLeod gauge – testing and calibration of pressure gauges – dead weight tester.

Bimetallic thermometers – electrical methods of temperature measurement – RTDs and their -Thermocouples, pyrometers – optical pyrometers – two colour radiation pyrometer.

#### TRANSFER FUNCTIONS

Definitions, Transfer function – Mathematical modeling of mechanical (translation and rotational), Electrical systems- mechanical-electrical analogies– Block Diagram reduction technique and Signal flow graphs.

#### RESPONSE AND STABILITY ANALYSIS

Time response of First order & second order systems-concept of stability, necessary condition stability- Routh Stability criterion Polar and Bode plots –Simple Problems.

#### TEXT BOOKS

1. Ernest O.Doebelin, *Measurement systems Application and Design*, International Student Edition, IV Edition, McGraw-Hill Book Company, 1998.
2. R.K.Jain, *Mechanical and Industrial Measurements*, Khanna Publishers, New Delhi, 1999.
3. Katsuhiko Ogata, *Modern Control Engineering*, 2<sup>nd</sup> edition, Prentice Hall of India Private Ltd, New Delhi, 1995

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>MH 0307</b>	<b>PLC AND DATA ACQUISITION SYSTEMS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

#### **PURPOSE**

To provide students the fundamentals of PLC and Data acquisition system

#### **INSTRUCTIONAL OBJECTIVES**

On completion of the course the students will be able to

1. Understand the basic of data conversion and data acquisition
2. Understand the fundamental of PLC.

#### **COMPUTER CONTROL-INTRODUCTION**

Need of computer in a control system-Functional block diagram of a computer control system-Data loggers-Supervisory computer control- Direct digital control-Digital control interfacing-SCADA.(Elementary treatment only).

#### **DATA CONVERTERS**

DACs-Basic DAC Techniques-Weighted Resistor, R-2R Ladder and Inverted R-2R ladder type DACs- ADCs – Parallel ADC, Dual slope ADC, Successive Approximation ADC-Comparison of A/D conversion techniques-DAC/ADC specifications - Typical IC's for DAC, ADC – Isolation amplifiers.

#### **DATA ACQUISITION SYSTEMS**

Sampling theorem – Sampling and digitizing – Aliasing – Sample and hold circuit – Practical implementation of sampling and digitizing – Definition, design and need for data acquisition systems – Interfacing ADC and DAC with Microprocessor / Multiplexer - Multiplexed channel operation –Microprocessor/PC based acquisition systems.

#### **PLC**

Evolution of PLC's – Sequential and programmable controllers – Architecture- Programming of PLC – Relay logic – Ladder logic – Gates, Flip flops and Timers.

#### **COMMUNICATION IN PLC's**

Requirement of communication networks of PLC – connecting PLC to computer – Interlocks and alarms - Case study of Tank level control system and Sequential switching of motors.

#### **REFERENCE BOOKS**

1. Petrezeulla, *Programmable Controllers*, McGraw Hill , 1989.
2. Hughes,T., *Programmable Logic Controllers*, ISA Press, 1989.
3. Clayton, G.B., *Data Converters*, The MacMillan Press Ltd., 1982.
4. Curtis D. Johnson., *Process Control Instrumentation Tech*, 8<sup>th</sup> Edition, Prentice Hall, June 2005.
5. Roy Choudhury. D and Shail B.Jain, *Linear Integrated circuits*, New age International Pvt .Ltd, 2003.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>IC0464</b>	<b>MICROPROCESSOR BASED SYSTEM DESIGN</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

#### **PURPOSE**

This course aims at introducing the need of microcontroller 8 bits and 16 bits in a device/ instrument development.

#### **INSTRUCTIONAL OBJECTIVES**

On completion of the course the student will be able to

1. Understand the need of Micro-controller family.
2. Develop the assembly level programs based on Intel 8083, 8096 & PIC microcontrollers.
3. Design the detailed hardware circuits for the given application.
4. Identify the need for I/O and memory expansion methods for an application.

Need for microprocessor based system design – Design cycle – dimensions of the design problem – Hardware design and software design – System integration.

**Structure and Characteristics:** 8253 Timer / Counter 8259 interrupt controller – 8279 keyboard / display controller – 6845 CRT controller 8237 DMA controller – 8272 diskette controller.

### INPUT AND OUTPUT ALGORITHMIC PROCESSES

I/O control – I/O timing – Data buffering with FIFOs – Keyboards and switches – Remote instrument control – Self test hardware. Keyboard parsing – Real time programming – Self test algorithm. Multiplication and division algorithms.

### TROUBLESHOOTING SYSTEMS – LOGIC ANALYSERS

Logic state analysers, Logic timing analysers, Display modes, Logic analysers features – Signature analysis, Error detection using signature analysis. Development systems: Basic features – software development aids – Development system architecture – Emulators, system software – Assembler, linker, loader.

### 8086 /8088 BASED MULTIPROCESSING SYSTEM

Review of Architecture and Instruction Set of 8086 Processor Coprocessor configuration, closely coupled configurations, loosely coupled configurations – 8087 coprocessor: Architecture, Instruction set – 8089 I/O processor.

### SYSTEM DESIGN APPLICATIONS

LCR meter – PID controller – DC motor speed control – Digital weighing machine – Temperature control – Controller for a washing machine.

### REFERENCE BOOKS

1. John B. Peatman, *Microcomputer Based Interfacing*, McGraw Hill, 1988.
2. Douglass V. Hall, *Microprocessor and Interfacing*, McGraw Hill, 1987.
3. Williams, G.B., *Troubleshooting on Microprocessor Based Systems*, Pergamon Press 1984.
4. Yu-Cheng Liu and Glenn A. Gibson, *Microcomputer systems, The 8086/8088 family*, Second edition, Prentice Hall of India, 1990.

### ELECTIVE V

		L	T	P	C
ME0061	INDUSTRIAL ENGINEERING	3	0	0	3
	Prerequisite				
	Nil				

### PURPOSE

To provide the basic features of Industrial Engineering like work study, material handling, production planning control, wages and incentives etc.

### INSTRUCTIONAL OBJECTIVES

After completion of this course the students will learn

1. The technique and procedures of work study
2. To analyse to planning procedures Human effectiveness
3. To know the methods of wage payment.

### WORK MEASUREMENT AND WORK STUDY

Work measurement, Techniques- Production study, Time study, Standard time-Rating factors- Work sampling, Work study, Techniques- Human factors- Work study and productivity-method study, Techniques and procedures- charging Techniques- Motion economy principles- SIMO chart-Ergonomics and Industrial design.

### PLANT LAYOUT AND MATERIAL HANDLING

Plant location, site selection- Plant layout types, need, factors influencing the layout - Tools and techniques for developing layout, process chart, flow diagram, string diagram, Template and Scale models- Layout Planning procedure- Assembly line balancing. Material Handling, scope and importance- Types of material handling systems-factors influencing material handling- methods of material handling.

### WORK DESIGN, ERGONOMICS, PRODUCTION & PRODUCTIVITY

Introduction to work design-Work design-for increased productivity, the work system design. Introduction to job design- Effective job design-Environmental factors, organizational factors & behavioral factors. Ergonomics

-Objectives' system approach of ergonomic model-Man-machine system Production and productivity-Definition of production, function and type of production- Definition of productivity- Productivity measurement.

### **PRODUCTION PLANNING AND CONTROL**

Objectives of PPC- Functions of PPC- Aspects of product development and design- Process Planning-Principles of Standardization, specialization, Simplification-Group Technology- Optimum Batch size- ABC analysis-Value Engineering.

### **WAGES AND INCENTIVES**

Wages and salary administration- Meaning principles- Techniques of wage fixation- Job evaluation- Merit rating- Methods of wage payment. Incentive scheme, Types, Advantages and disadvantages-Productivity base incentives, Case Example- Evaluation of incentive scheme.

### **TEXTBOOKS**

1. Khanna O. P., *Industrial Engineering and Management*, Khanna publishers, New Delhi, 1999.
2. Samuel Ellen, *Elements of Production Planning and Control*, McMillan and Co., 1971.

### **REFERENCE BOOKS**

1. Kumar B., *Industrial Engineering*, Khanna Publishers, New Delhi, 1998.
2. James M. Apple, *Principles of Layout and Material Handling*, Ronald press, 1997.
3. Maynard, H., *Industrial Engineering Hand Book*, McGraw Hill Book Co., New York, 1999.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME0062</b>	<b>MATERIALS MANAGEMENT</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

### **PURPOSE**

To expose the students to the different components and functions of material management

### **INSTRUCTIONAL OBJECTIVES**

1. Inventory control procedures
2. Codification of materials
3. Purchase policies and procedures

### **INTRODUCTION**

Objectives of materials-the function of purchasing and material management- significance of specifications-standardization-make or buy decision, buying process.

### **MATERIALS PLANNING AND CONTROL**

Material forecasting-selection inventory control-Spare parts management-Inventory systems-lead time analysis, administrative lead time, supplier lead time, transport lead time and inspection lead time-flow charting techniques to reduce various types of lead time- materials requirement planning- aggregate inventory management.

### **STORAGE AND DISTRIBUTION**

Codification of materials-storage design-stores layout - storage systems and equipment - stores preservation - stores procedures - stock valuation and verification - ware housing and distribution management.

### **PURCHASE FUNCTION**

Purchasing policies and procedures-legal aspects of purchasing-selection of sources of supply-vendor evaluation and rating, vendor development-price, cost analysis.

### **MATERIALS ACCOUNTING AND BUDGETING**

Evaluation of materials management performance-Information systems and computer in materials management.

### **TEXT BOOK**

1. Gopalakrishnan, P., *Purchasing and Materials Management*, Tata McGraw Hill, 1990.

## REFERENCE BOOKS

1. Camer Lee and Donald M Dubbler, *Purchasing and Materials Management*, Text and cases, Tata McGraw Hill, 1997.
2. Mark, J. V., *Operations Management*, McGraw Hill Publishers, 1984.
3. Westing, J. K., Fine, E.V. and Zone, C.T., *Purchasing Management Principles*, John Wiley & Sons, New York, 1986.

		L	T	P	C
ME0063	HUMAN RELATIONS MANAGEMENT	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To expose the students to the functions of Human Relations Management.

## INSTRUCTIONAL OBJECTIVES

After completion of this course the students will be able to

1. Understand the human relations
2. Understand the recruitment procedures
3. Acquire the knowledge of Career development and counseling.

## HUMAN RESOURCE DEVELOPMENT

Meaning – Strategic framework for HRM and HRD – Vision, Mission and Values – Importance – Challenges to Organisations – HRD Functions - Roles of HRD Professionals - HRD Needs Assessment - HRD practices – Measures of HRD performance – Links to HR, Strategy and Business Goals – HRD Program Implementation and Evaluation – Recent trends – Strategic Capability, Bench Marking and HRD Audit.

## E-HRM

e- Employee profile– e- selection and recruitment - Virtual learning and Orientation – e - training and development – e- Performance management and Compensation design – Development and Implementation of HRIS – Designing HR portals – Issues in employee privacy – Employee surveys online.

## CROSS CULTURAL HRM

Domestic Vs International HRM - Cultural Dynamics - Culture Assessment - Cross Cultural Education and Training Programs – Leadership and Strategic HR Issues in International Assignments - Current challenges in Outsourcing, Cross border M and A- Repatriation etc. - Building Multicultural Organisations - International Compensation.

## CAREER & COMPETENCY DEVELOPMENT

Career Concepts – Roles – Career stages – Career planning and Process – Career development Models– Career Motivation and Enrichment –Managing Career plateaus- Designing Effective Career Development Systems – Competencies and Career Management – Competency Mapping Models – Equity and Competency based Compensation.

## EMPLOYEE COACHING AND COUNSELING

Need for Coaching – Role of HR in coaching – Coaching and Performance – Skills for Effective Coaching – Coaching Effectiveness– Need for Counseling – Role of HR in Counseling - Components of Counseling Programs – Counseling Effectiveness – Employee Health and Welfare Programs – Work Stress – Sources - Consequences – Stress Management Techniques.- Eastern and Western Practices - Self Management and Emotional Intelligence.

## TEXT BOOKS

1. Jeffrey A Mello, *Strategic Human Resource Management*, Thomson, Singapore, Southwestern, 2003.
2. Randy L. Desimone, Jon M. Werner and David M. Marris, *Human Resource Development*, Thomson Southwestern, Singapore, 2002.

## REFERENCE BOOKS

1. Robert L. Mathis and John H. Jackson, *Human Resource Management*, Thomson Southwestern, Singapore, 2003.



2. Rosemary Harrison, *Employee Development*, University Press India Ltd., New Delhi, 2003.
3. Srinivas Kandula, *Human Resource Management in Practice*, Prentice Hall of India, New Delhi, 2004.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0064</b>	<b>ENTREPRENEURSHIP DEVELOPMENT</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

### **PURPOSE**

This course provides the basic knowledge on aspects of Entrepreneurship and supports extended to entrepreneurs.

### **INSTRUCTIONAL OBJECTIVES**

On completion of this course the student is expected to

1. Understand the broad spectrum of entrepreneurship.
2. Know about the prelims of setting up of a business unit.
3. Understand the purchasing and marketing basics of the business.
4. Aware of various supports extended by banks and institutions.

### **ENTREPRENEURSHIP**

Historical Perspective of Entrepreneurship-Entrepreneur-Traits of Entrepreneurs-Types of Entrepreneurs-Intrepreneur-Difference between Entrepreneur and Intrepreneur-Entrepreneurship in Economic growth, Factors affecting Entrepreneurial Growth, Major motives influencing Entrepreneur.

### **BUSINESS**

Small Enterprises-definition, Classification- Characteristics, Web and e business - Ownership structure-Project Formulation- Sources of Information- Steps involved in setting up a business- -Identifying, Selecting a good business opportunity, Market survey and research, Techno economic feasibility assessment-Preliminary Project report –Project Appraisal – Project implementation-Network Analysis, Techniques of PERT/CPM

### **FINANCING & ACCOUNTING**

Sources of finance, Institutional Finance, Term loans, Capital structure, Management of working capital, Costing, Break Even Analysis, Taxation-Income Tax, Excise Duty- Sales Tax. Purchasing Policies and procedures-Methods of purchasing-Stores Management-Book keeping

### **MARKETING & GROWTH STRATEGIES**

Principles of Marketing, Assessment of market needs, Demand Forecasting, Product Life cycle-Sales Promotion Strategies- Product mix- Advertising- Distribution Channels. Growth Strategies- Expansion, Diversification, Joint venture, Merger, Sub-contracting

### **INSTITUTIONAL SUPPORT TO ENTREPRENEURS**

Institutional support to Entrepreneurs- Government policy for small scale industries, Institutions for entrepreneurial growth – various schemes-Self Help Group-Sickness in industry-causes-steps for correction and rehabilitation

(Field work-Collection of information on schemes of Entrepreneurial Support and Presentation)

### **TEXT BOOKS**

1. Khanka, S.S., *Entrepreneurial Development*, S.Chand & Co Ltd, New Delhi, 1999.
2. Philip Kotler, *Principles of Marketing*, Prentice Hall of India, 1995.
3. Lamer Lee and Donald W.Dobler, *Purchasing and Materials Management*, Tata McGraw Hill, 1996

### **REFERENCE BOOKS**

1. EDII –Faculty and External Experts, *A Hand Book of new Entrepreneurs*, Published by Entrepreneurship Development Institute of India, Ahmedabad, 1986
2. Saravanel, P., *Entrepreneurial Development*, Ess Pee Kay Publishing House, Chennai, 1997
3. Gopalakrishnan, P., *Hand book of Materials Management*, Prentice Hall of India, 1996.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0065</b>	<b>FACILITIES PLANNING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

#### **PURPOSE**

On completion of the course the students are expected to design facilities for an industry to meet specific requirements.

#### **INSTRUCTIONAL OBJECTIVES**

To familiarize the students with

1. Facilities planning process
2. The strategies adopted for designing a facility
3. Evaluate the existing facility and modify to meet the requirements

#### **INTRODUCTION**

Significance and objectives of facilities planning. Facilities planning process, developing facilities planning strategies. Influence of product, process and schedule design. Facilities design.

#### **REQUIREMENTS AND RELATIONSHIPS**

Department planning, activity relationship, flow – patterns, planning and measuring. Space requirements. Personnel requirements- employee-facility interface, restrooms, food services, health services. Office facility planning.

#### **ALTERNATIVE CONCEPTS AND TECHNIQUES**

Material Handling: Principles and classification. Designing material handling systems, estimating material handling costs, safety consideration.

Layout Planning Models: Basic layout types, layout procedures. Algorithmic approaches-pair-wise exchange method, graph based approaches – CRAFT, BLOCPLAN, LOGIC, MULTIPLE. Multi floor facility layout. Developing layout alternatives, Computer assisted layout planning – ALDEP, CORELAP, CRAFT. Commercial facility layout packages.

#### **FACILITY DESIGN**

Facility design for various functions – warehouse operation, manufacturing systems, services.

#### **EVALUATING, SELECTING AND MAINTAINING**

Facilities plan - Evaluating, selecting, preparing, presenting, implementing and maintaining.

#### **TEXT BOOK**

1. Tompkins J.A., White J.A., Bozer Y.A., and Tan Choco J.M.A., *Facilities Planning*, 3<sup>rd</sup> edition, John Wiley and sons, India, 2003.

#### **REFERENCE BOOK**

1. Francis R.L., McGinnis L.F., and White J.A., *Facility Layout and Location: An analytical approach*, Prentice Hall, NJ, 1992.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0066</b>	<b>INDUSTRIAL SAFETY AND ENVIRONMENT</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				
	Nil				

#### **PURPOSE**

On completion of the course the student will be familiarized with the safety issues in design, handling and industrial environment.

#### **INSTRUCTIONAL OBJECTIVES**

1. The students will be able to conduct basic safety inspections using strategies that they have developed.
2. The students will be able to identify and demonstrate a working knowledge of the domain of occupation health and safety.
3. The students will be able to create a document addressing the principles for developing and implementing a successful occupational health and safety program and evaluation of a work site.

## ACCIDENT PREVENTION

Definitions and theories.- Accident – Injury –unsafe act – unsafe condition – Dangerous occurrence –Theories and principles of accident causation – Cost of accidents – Accident reporting and investigations – Safety committees – need – types – advantages. Safety Education and training- Importance - various training methods – Accident prevention – Motivating factors – Safety suggestion schemes. Safety performance – Definitions connected with measuring safety performance as per Indian and International standards .

## SAFETY IN MATERIAL HANDLING

General safety consideration in material handling - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers. Ergonomic consideration in material handling, design, installation, operation and maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms. Selection, operation and maintenance of Industrial Trucks – Mobile Cranes – Tower crane.

## SAFETY IN CHEMICAL INDUSTRIES

Safety in the design process of chemical plants- Safety in operational and maintenance – Exposure of personnel, Operational activities and hazards – Safety in storage and Handling of chemical and gases – Hazards during transportation – pipeline transport – safety in chemical laboratories. Specific safety consideration for Cement, paper, pharmaceutical, petroleum, petro- chemical, rubber, fertilizer and distilleries.

## ENVIRONMENTAL IMPACT ASSESSMENT

Evolution of EIA – Concepts – Methodologies – Screening – Scoping — Checklist.Rapid and Comprehensive EIA – Legislative and Environmental Clearance procedure in India – Prediction tools for EIA. Assesment of Impact – Air – Water – Soil – Noise- Biological. Socio cultural environment – Public participation – Resettlement and Rehabilitation.Documentation of EIA .

## REGULATIONS FOR HEALTH, SAFETY AND ENVIRONMENT

Factories act and rules; Indian explosive act - Gas cylinder rules. Environmental pollution act - Indian petroleum act and rules. Oil industry safety directorate (OISD) - Indian Electricity act and rules. Mines act and rules - Indian motor vehicles act and rules.

## TEXT BOOKS

1. Handlin, W., *Industrial Hand Book*, McGraw-Hill, 2000.
2. Anton, T. J., *Occupational safety and health management*, (2nd ed.). New York, NY: McGraw Hill, Inc, 1989.

## REFERENCE BOOKS

1. Heinrich, H.W., *Industrial Accident Prevention*, McGraw-Hill, 1980
2. Rudenko, N., *Material Handling Equipments*, Mir Publishers, Moscow, 1981.
3. Lees, F.P., *Loss Prevention in Process Industries*, Butterworths, NewDelhi, 1986.
4. Canter, R. L., *Environmental Impact Assessment*, McGraw Hill.
5. IS CODES: IS 5903, IS 807, IS 2760, IS 14469, IS 13367-1, IS 5324, IS 7167, IS 7155, IS 1800.1, IS 3521.  
Oil Industry Safety Directorate, Govt. of India.

		L	T	P	C
ME 0067	SUPPLY CHAIN MANAGEMENT	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To provide knowledge on Logistics, net work relations, supply processes, ware – house and supply chain of goods.

## INSTRUCTIONAL OBJECTIVES

The end of the course, students will be able to know

1. Logistics management
2. Product Data Management
3. Ware-House Management
4. Transportation net-work

## 5. Supply Chain of goods

### INTRODUCTION TO LOGISTICS

Logistics- concepts, definitions and approaches, factors influencing logistics. Supply chain – basic tasks, definitions and approaches, influencing supply chain – a new corporate model.

### PHASES OF SUPPLY CHAIN

The new paradigm shift, the modular company, the network relations, supply processes, procurement processes – distribution management.

### EVOLUTION OF SUPPLY CHAIN MODELS

Strategy and structure – factors of supply chain– manufacturing strategy Stages, supply chain progress – model for competing through supply chain Management – PLC grid, supply chain redesign – linking supply chain with customer.

### SUPPLY CHAIN ACTIVITIES

Structuring the SC, SC and new products, functional roles in SC, SC design frame- work, collaborative product commerce (CPC)

### SCM ORGANISATION AND INFORMATION SYSTEM

The management task, logistics organization, the logistics information systems – topology of SC application - Product Data Management, warehouse management system MRP- I, MRP - II, ERP., – Case study, ERP Software's

### TEXT BOOKS

1. Shari, P.B., Lassen, T.S., *Managing the global supply chain*, Viva books, New Delhi, 2000
2. Ayers, J.B., *Hand book of supply chain management*, The St. Lencie Press, 2000

### REFERENCE BOOKS

1. Nicolas, J.N., *Competitive manufacturing management – continuous improvement, Lean production, customer focused quality*, McGrawHill, NY, 1998.
2. Steudel, H.J. and Desruelle, P. *Manufacturing in the nineteen – How to become a mean, lean and world class Competitor*, Van No strand Reinhold, NY, 1992.

		L	T	P	C
ME 0068	TQM AND RELIABILITY ENGINEERING	3	1	0	4
	Prerequisite				
	Nil				

### PURPOSE

To provide knowledge about Total Quality Management (TQM), TQM tools and techniques applied to Manufacturing and also about reliability and maintainability of different systems.

### INSTRUCTIONAL OBJECTIVES

At the end of the course students will be able to know

1. Meaning of TQM and Theories about TQM
2. Planning and manufacturing for quality its tools and techniques
3. Human involvement to improve quality and the development and transformation due to such involvement.
4. About failure models, component reliability & system reliability
5. About mean down time, maintainability of systems & condition monitoring.

### BASIC CONCEPTS

Evolution of total quality Management, Definition of quality, Comparison between traditional approach and TQM, Deming, Crosby, Juran, Taguchi, Ishikawa theories, Quality costs- product quality Vs Service quality Strategic planning- Goal setting, steps involved in Strategic planning, TQM implementation.

## **TQM PRINCIPLES & BASIC TOOLS**

Customer Satisfaction – Types of Customers, customer supplier chain , customer perception of Quality  
Customer feed back, customer complaints, Customer retention, Service quality.

Employee involvement – Employee motivation, Maslow's Hierarchy of needs, Herzberg theory,, Empowerment & Team work

Basic Tools: Introduction to Seven basic tools –Check sheets, Histograms, Control charts, Pareto diagram, Cause & effect diagram, Stratification, Scatter diagrams.

## **NEW SEVEN MANAGEMENT TOOLS & ADVANCED TOOLS**

Affinity diagram, Relations diagram, Tree diagram, matrix diagram, Matrix data analysis diagram, Process decision program chart, Arrow diagram.

Advanced QC tools: Advanced QC tools like QFD, Root cause analysis, Taguchi method, Mistake proofing (poka-yoke), Failure mode and effects analysis (FMEAs), failure mode and effects criticality analysis (FMECAs) and Fault tree analysis (FTAs) etc. Quality Management Systems.

## **RELIABILITY**

Definition- Probabilistic nature of failures, Mean failure rate, Meantime between failures, hazard rate, hazard models, Weibull model- System reliability improvement- Redundancy- Series- Parallel and Mixed configurations.

## **MAINTAINABILITY**

Introduction, choice of maintenance strategy. Mean time- to Repair (MTTR), Factors contributing to Mean Down Time (MDT), fault diagnosis, and routine testing for unrevealed faults. Factors contributing to Mean Maintenance Time- (MMT) on condition maintenance periodic condition monitoring, continuous condition monitoring, economics of maintenance.

## **TEXT BOOKS**

1. Joel E. Rose, *Total Quality Management*, 2<sup>nd</sup> Edn, Kogan Page Ltd., USA 1993.
2. Srinath L.S., *Reliability Engineering*, Affiliated East West Press, New Delhi 1995.

## **REFERENCE BOOKS**

1. Balagurusamy E., *Reliability Engineering*, Tata McGraw Hill pub. Company., New Delhi. 1984
2. Greg bound et.al, *Beyond Total Quality Management towards the emerging paradigm*, McGraw Hill Inc. 1994.

		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>ME 0069</b>	<b>MARKETING AND SALES MANAGEMENT</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite				

## **PURPOSE**

The students will be exposed to the hardcore and advance concepts of both marketing and sales management

## **INSTRUCTIONAL OBJECTIVES**

At the end of the course students will be able to know

1. The products sales competitive features
2. Marketing trend
3. Achievement of Sales target and manage the sales team
4. Customer's satisfaction
5. Repeat customers

## **INTRODUCTION TO MARKETING**

Market- definition, types. Kinds of goods, marketing role, characteristics. Marketing interface with other functional areas. Marketing management forces.

## UNDERSTANDING CONSUMER BEHAVIOUR

Consumer values, buyer behaviour- influencing factors, models. Consumer and industrial buyers-identifying target customers-market segmentation-positioning

## MARKETING MIX ELEMENTS

Marketing mix- **Product:** – what is product – consumer & industrial products – new product development – design-branding-packaging-labeling-product life cycle-sales forecasting & demand estimation –**Price:** Pricing – **Place:** Nature of distribution channel- channel design decisions- retailing-wholesaling. **Promotion:** Advertising and personal selling-direct selling

## SALES MANAGEMENT

Marketing management Vs. Sales management- sales management and business enterprise- the role of personal selling-skills for successful sales persons – designing the sales force strategy and structure –recruitment – selection – training-compensation-motivation of sales people.

## CURRENT TRENDS IN MARKETING

Information technology and its impact in marketing decisions-e-commerce-multilevel marketing-consumer protection: awareness of consumer rights, laws and consumerism

## TEXT BOOK

1. Kotler p., and Armstrong, *Principles of Marketing*, 11<sup>th</sup> edition, PHI.

## REFERENCE BOOKS

1. Still R.R., Cundiff E.W., and Govoni N.A.P., *Sales Management*, PHI.
2. Sherlekar, S.A., *Marketing Management*, 3<sup>rd</sup> edition, MacMillan, India.

		L	T	P	C
AE 0013	VEHICLE TRANSPORT MANAGEMENT	3	0	0	3
	Prerequisite				
	Nil				

## PURPOSE

To provide knowledge about Management of Transport.

## INSTRUCTIONAL OBJECTIVES

At the end of the course, students will be able to know

1. Vehicle maintenance
2. Organization and management.
3. Budgeting, supply management.
4. Scheduling and fare structure.
5. Motor vehicle act

## ORGANISATION AND MANAGEMENT

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

## VEHICLE MAINTENANCE

Scheduled and unscheduled maintenance - Planning and scope - Evaluation of PMI programme – Work scheduling - Overtime - Breakdown analysis - Control of repair backlogs - Cost of options.

## VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET

Cost of inventory - Balancing inventory cost against downtime - Parts control - Bin tag systems – Time management - Time record keeping - Budget activity - Capital expenditures - Classification of vehicle expenses - Fleet management and data processing - Data processing systems - Software. Model - Computer controlling of fleet activity - Energy management.

### **SCHEDULING AND FARE STRUCTURE**

Route planning - Scheduling of transport vehicles - Preparation of timetable – preparation of vehicle and crew schedule - Costs, fare structure – Fare concessions - Methods of fare collection - Preparation of fare table.

### **MOTOR VEHICLE ACT**

Schedules and sections - Registration of motor vehicles - Licensing of drivers and conductors - Control of permits - Limits of speed - traffic signs - Constructional regulations - Description of goods carrier, delivery van, tanker, tipper, municipal, fire fighting and break down service vehicle.

### **REFERENCE BOOKS**

1. John Dolu, *Fleet Management*, McGraw-Hill Co., 1984
2. Government Publication, *The Motor vehicle Act*, 1989.
3. Rex W Faulks, *Bus and Coach Operation*, Butterworth, 1987.
4. Kitchin.L.D., *Bus operation*, 3<sup>rd</sup> Edition, Illiffe and Sons Ltd., London, 1992.
5. Kadiyali.L.R., *Traffic engineering and Transport Planning*.