

**ANNA UNIVERSITY TIRUCHIRAPPALLI**  
**Tiruchirappalli – 620 024**

**Regulations 2008**

**Curriculum**

**B.E. AUTOMOBILE ENGINEERING**

**SEMESTER III**

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>MA1201</b>	Transforms and Partial Differential Equations	3	1	0	4
2	<b>ME1201</b>	Engineering Thermodynamics	3	1	0	4
3	<b>CE1208</b>	Fluid Mechanics and Machinery	3	1	0	4
4	<b>AT1201</b>	Automotive Engines	4	0	0	4
5	<b>ME1204</b>	Mechanics of Machines	3	1	0	4
6	<b>PR1206</b>	Production Technology	3	0	0	3
<b>Practical</b>						
7	<b>AT1202</b>	Automotive Components Laboratory	0	0	3	2
8	<b>CE1211</b>	Fluid Mechanics and Machinery Laboratory	0	0	3	2
9	<b>PR1207</b>	Manufacturing Technology Laboratory	0	0	3	2
<b>Total</b>						<b>29</b>

**SEMESTER IV**

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>MA1254</b>	Statistics and Numerical Methods	3	1	0	4
2	<b>AT1251</b>	Applied Thermodynamics and Heat Transfer	3	1	0	4
3	<b>ME1253</b>	Engineering Materials and Metallurgy	3	0	0	3
4	<b>CE1259</b>	Strength of Materials	3	1	0	4
5	<b>EC1265</b>	Electronics and Microprocessors	3	0	0	3
6	<b>AT1252</b>	Automotive Chassis	3	0	0	3
<b>Practical</b>						
7	<b>AT1253</b>	Engine Performance and Emission Testing Laboratory	0	0	3	2
8	<b>ME1255</b>	Computer Aided Machine Drawing Laboratory	0	0	4	2
9	<b>EC1266</b>	Electronics and Microprocessors Laboratory	0	0	3	2
10	<b>CE1260</b>	Strength of Materials Laboratory	0	0	3	2
<b>Total</b>						<b>29</b>

## SEMESTER V

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>HS1201</b>	Environmental Science and Engineering	3	0	0	3
2	<b>AT1301</b>	Automotive Electrical and Electronics	3	0	0	3
3	<b>AT1302</b>	Automotive Engines Components Design	3	1	0	4
4	<b>AT1303</b>	Fuels and Lubricants	3	0	0	3
5	<b>ME1304</b>	Engineering Metrology and Measurements	3	0	0	3
6	<b>AT1304</b>	Vehicle Dynamics	3	1	0	4
<b>Practical</b>						
7	<b>AT1305</b>	Auto Electrical and Electronics Laboratory	0	0	3	2
8	<b>AT1306</b>	Automotive Chassis Components Laboratory	0	0	3	2
9	<b>AT1307</b>	Fuels & Lubricants Laboratory	0	0	3	2
<b>Total</b>						<b>26</b>

## SEMESTER VI

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>MG1351</b>	Principles of Management	3	0	0	3
2	<b>AT1351</b>	Automotive Chassis Design	3	1	0	4
3	<b>AT1352</b>	Computer Aided Vehicle Design Characteristics	3	1	0	4
4	<b>AT1353</b>	Automotive Pollution and Control	3	0	0	3
5	<b>AT1354</b>	Automotive Transmission	3	0	0	3
6	<b>E1****</b>	Elective I	3	0	0	3
<b>Practical</b>						
7	<b>AT1355</b>	Reconditioning Laboratory	0	0	3	2
8	<b>AT1356</b>	Computer Aided Engine Design Laboratory	0	0	3	2
9	<b>AT1357</b>	Computer Aided Chassis Design Laboratory	0	0	3	2
<b>Total</b>						<b>26</b>

## SEMESTER VII

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>MG1301</b>	Total Quality Management	3	0	0	3
2	<b>ME1401</b>	Finite Element Analysis	3	1	0	4
3	<b>AT1401</b>	Vehicle Maintenance	3	0	0	3
4	<b>AT1402</b>	Vehicle Body Engineering	3	1	0	4
5	<b>E2****</b>	Elective II	3	0	0	3
6	<b>E3****</b>	Elective III	3	0	0	3
<b>Practical</b>						
7	<b>AT1403</b>	Vehicle Maintenance Laboratory	0	0	3	2
8	<b>AT1404</b>	Computer Aided Manufacturing Laboratory	0	0	3	2
9	<b>HS1301</b>	Communication and Soft Skills Laboratory	0	0	3	2
<b>Total</b>						<b>26</b>

## SEMESTER VIII

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>GE1451</b>	Engineering Economics and Cost Analysis	3	0	0	3
2	<b>E4****</b>	Elective IV	3	0	0	3
3	<b>E5****</b>	Elective V	3	0	0	3
<b>Practical</b>						
4	<b>AT1455</b>	Project Work	0	0	6	6
<b>Total</b>						<b>15</b>

## ELECTIVES FOR SEMESTER VI

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>AT1001</b>	Automotive Air-conditioning	3	0	0	3
2	<b>AT1002</b>	Alternate Fuels and Energy Systems	3	0	0	3
3	<b>ME1002</b>	Vibration and Noise Control	3	0	0	3
4	<b>AT1003</b>	Advanced Theory of I.C. Engines	3	0	0	3
5	<b>PR1353</b>	Quality Control and Reliability Engineering	3	0	0	3
6	<b>MA1251</b>	Numerical Methods	3	0	0	3
7	<b>GE1001</b>	Intellectual Property Rights (IPR)	3	0	0	3
8	<b>GE1002</b>	Indian Constitution and Society	3	0	0	3

## ELECTIVES FOR SEMESTER VII

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>AT1004</b>	Automotive Aerodynamics	3	0	0	3
2	<b>AT1005</b>	Two and Three Wheeled Vehicles	3	0	0	3
3	<b>ME1008</b>	Composite Materials	3	0	0	3
4	<b>PR1303</b>	Design of Jigs, Fixtures and Press Tools	3	0	0	3
5	<b>AT1006</b>	Computer Simulation of I.C Engine Processes	3	0	0	3
6	<b>IC1404</b>	Robotics	3	0	0	3

## ELECTIVES FOR SEMESTER VIII

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>AT1007</b>	Transport Management	3	0	0	3
2	<b>MG1001</b>	Operations Research	3	0	0	3
3	<b>AT1008</b>	Automotive Safety	3	0	0	3
4	<b>AT1009</b>	Combustion and Heat Transfer	3	0	0	3
5	<b>ME1011</b>	Product Design and Costing	3	0	0	3
6	<b>ME1013</b>	Entrepreneurship Development	3	0	0	3
7	<b>AT1010</b>	Modern Automobile Accessories	3	0	0	3
8	<b>AT1011</b>	Fuel Cells Applications	3	0	0	3
9	<b>GE1301</b>	Professional Ethics and Human Values	3	0	0	3

# ANNA UNIVERSITY TIRUCHIRAPPALLI

**Tiruchirappalli – 620 024**

**Regulations 2008**

**Syllabus**

## **B.E. AUTOMOBILE ENGINEERING**

### **SEMESTER III**

#### **MA1201 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS**

(Common to Aeronautical, Automobile, Marine, Mechanical and Production)

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

#### **UNIT I      FOURIER SERIES      9**

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

#### **UNIT II      FOURIER TRANSFORMS      9**

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

#### **UNIT III      PARTIAL DIFFERENTIAL EQUATIONS      9**

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

#### **UNIT IV      APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS      9**

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

#### **UNIT V      Z -TRANSFORMS AND DIFFERENCE EQUATIONS      9**

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

**L: 45 T: 15 Total: 60**

## **TEXT BOOK**

1. Grewal, B.S, “Higher Engineering Mathematics”, 40th Edition, Khanna publishers, 2007.

## **REFERENCES**

1. Bali.N.P and Manish Goyal, “A Textbook of Engineering Mathematics”, 7th Edition, Laxmi Publications (P) Ltd., 2007.
2. Ramana.B.V., “Higher Engineering Mathematics”, Tata Mc-GrawHill Publishing Company limited, 2007.
3. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2007.
4. Erwin Kreyszig, “Advanced Engineering Mathematics”, 8th Edition, Wiley India, 2007.

# ME1201 – ENGINEERING THERMODYNAMICS

(Common to Mechanical and Automobile)

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

## **UNIT I BASIC CONCEPTS AND FIRST LAW 9**

Concept of continuum – Macroscopic approach – Thermodynamic systems – Closed – Open – Isolated – Thermodynamic Property – State – Path and process – Quasi-static process – Work – Modes of work – Zeroth law of thermodynamics – Concept of temperature and heat – Concept of ideal and real gases – First law of thermodynamics – Application to closed and open systems – Internal energy – Specific heat capacities – Enthalpy – Steady flow process with reference to various thermal equipments.

## **UNIT II SECOND LAW 9**

Second law of thermodynamics – Kelvin’s and Clausius statements of second law – Reversibility and irreversibility – Carnot theorem – Carnot cycle – Reversed Carnot cycle – efficiency – COP – Thermodynamic temperature scale – Clausius inequality – Concept of entropy – Entropy of ideal gas – Principle of increase of entropy – Availability.

## **UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 9**

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

## **UNIT IV IDEAL AND REAL GASES AND THERMODYNAMIC RELATIONS 9**

Gas mixtures – Properties ideal and real gases – Equations of state – Avogadro’s Law – Vander Waal’s equation of state – Compressibility factor – Compressibility chart – Dalton’s law of partial pressure – Exact differentials – T-D relations – Maxwell’s relations – Clausius Clapeyron equations – Joule – Thomson coefficient.

## **UNIT V PSYCHROMETRY 9**

Psychrometry and psychrometric charts – Property calculations of air vapour mixtures – Psychrometric process – Sensible heat exchange processes – Latent heat exchange processes – Adiabatic mixing – Evaporative cooling.

**L: 45 T: 15 Total: 60**

(Standard thermodynamic tables, Mollier diagram, Psychrometric chart and Refrigerant property tables may be used)

### **TEXT BOOKS**

1. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, 1998.
2. Cengel, “Thermodynamics – An Engineering Approach”, 3<sup>rd</sup> Edition, Tata McGraw Hill, 2003.

### **REFERENCES**

1. Holman.J.P., “Thermodynamics”, 3<sup>rd</sup> Edition, McGraw-Hill, 1995.
2. Venwylen and Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987.
3. Arora C.P, “Thermodynamics”, Tata McGraw-Hill, 2003.

## **CE1208 – FLUID MECHANICS AND MACHINERY**

(Common to Mechanical, Aeronautical, Automobile and Production)

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

### **UNIT I INTRODUCTION 9**

Units and Dimensions – Properties of fluids – Specific gravity – Specific weight – Viscosity – Compressibility – Vapour pressure and gas laws – Capillarity and surface tension – Flow characteristics: concepts of system and control volume – Application of control volume to continuity equation – Energy equation – Momentum equation – Moment of momentum equation.

### **UNIT II FLOW THROUGH CIRCULAR CONDUITS 9**

Laminar flow through circular conduits and circular annuli – Boundary layer concepts – Boundary layer thickness – Hydraulic and energy gradient – Darcy – Weisbach equation – Friction factor and Moody diagram – Commercial pipes – Minor losses – Flow through pipes in series and in parallel.

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

Dimension and units: Buckingham's  $\Pi$  theorem – Discussion on dimensionless parameters – Models and similitude – Applications of dimensionless parameters.

### **UNIT IV ROTO DYNAMIC MACHINES 9**

Homologous units – Specific speed – Elementary cascade theory – Theory of turbo machines – Euler's equation – Hydraulic efficiency – Velocity components at the entry and exit of the rotor – Velocity triangle for single stage radial flow and axial flow machines – Centrifugal pumps – Turbines – Performance curves for pumps and turbines.

### **UNIT V POSITIVE DISPLACEMENT MACHINES 9**

Reciprocating pumps – Indicator diagrams – Work saved by air vessels – Rotary pumps – Classification – Working and performance curves.

**L: 45 T: 15 Total: 60**

### **TEXT BOOKS**

1. Streeter. V. L., and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 1983.
2. Radhakrishnan. E, "Fluid Mechanics", 2nd Edition, Prentice Hall of India, 2007.

### **REFERENCES**

1. Ramamritham. S, "Fluid Mechanics, Hydraulics and Fluid Machines", Dhanpat Rai and Sons, 1988.
2. Kumar. K.L., "Engineering Fluid Mechanics", 7th Edition, Eurasia Publishing House (P) Ltd., 1995.
3. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", Laxmi Publications (P) Ltd., 2007.

## AT1201 – AUTOMOTIVE ENGINES

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

### **UNIT I CONSTRUCTION AND OPERATION 12**

Constructional details of spark ignition (SI) and compression ignition (CI) engines – Working principles – Two stroke SI and CI engines – Construction and working – Comparison of SI and CI engines and four stroke and two stroke engines – Engine classification – Firing order – Otto – Diesel – Dual cycles.

### **UNIT II FUEL SYSTEMS 12**

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

### **UNIT III COMBUSTION AND COMBUSTION CHAMBERS: 12**

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

### **UNIT IV SUPERCHARGING, TURBOCHARGING AND ENGINE TESTING 12**

Supercharging and turbo-charging – Different methods of turbo-charging – Inter-cooling – Turbocharger controls including – Waster gate – Variable geometry – Variable nozzle types – Dynamometers – Indicated thermal – Brake thermal and volumetric efficiencies – Measurement of friction – Cylinder pressure measurement – Engine performance maps – Engine testing standards.

### **UNIT V COOLING AND LUBRICATION SYSTEMS 12**

Need for cooling – Types of cooling systems – Air and liquid cooling systems – Thermo syphon and forced circulation and pressurized cooling systems – Properties of coolants – Requirements of lubrication systems – Types-mist – Pressure feed – Dry – Wet sump systems – Properties of lubricants.

**Total: 60**

### **TEXT BOOKS**

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

### **REFERENCES**

- 1 Heisler, “Advanced Engine Technology”, SAE Publication, Sep 1995.
- 2 Obert, E.F., “Internal Combustion Engines”, 3rd Edition, Text book Co., 1968.
- 3 Mathur and Sharma, “Internal Combustion Engines”, Dhanpat Rai and Sons, 2002.





## **TEXT BOOKS**

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

## **REFERENCES**

1. Serope Kalpajian, Schmid, S. R., “Manufacturing Processes for Engineering Materials”, 4th Edition, Pearson Education, Inc. 2007.
2. Jain, R.K. and Gupta, S.C., “Production Technology”, 16th Edition, Khanna Publishers, 2001.
3. “H.M.T. Production Technology – Handbook”, Tata McGraw-Hill, 2000.

## AT1202 – AUTOMOTIVE COMPONENTS LABORATORY

L	T	P	C
0	0	3	2

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

**Total: 45**

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

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

## **CE1211 – FLUID MECHANICS AND MACHINERY LABORATORY**

(Common to Mechanical, Production, Aeronautical and Automobile)

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

### **LIST OF EXPERIMENTS**

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

### **LIST OF EQUIPMENTS**

(for a batch of 30 students)

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

**Quantity: one each.**

**Total : 45**

# PR1207 – MANUFACTURING TECHNOLOGY LABORATORY

(Common to Aeronautical and Automobile)

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

## LIST OF EXPERIMENTS

### 1. LATHE

- 1.1. Facing, plain turning and step turning
- 1.2. Taper turning using compound rest.
- 1.3. Taper turning using taper turning attachment
- 1.4. Single start V thread, cutting and knurling
- 1.5. Boring and internal thread cutting.

### 2. SHAPER AND SLOTTER

- 2.1. Machining a V- block (in a Shaper)
- 2.2. Machining hexagonal shape (in a Shaper)
- 2.3. Machining internal key-way (in a slotter)

### 3. DRILLING

- 3.1. Drilling 4 or 6 holes at a given pitch circle on a plate
- 3.2. Drilling, Reaming and Tapping

### 4. MILLING

- 4.1. Plain Milling Exercise
- 4.2. Gear Milling Exercise

### 5. GRINDING

Cylindrical Grinding Exercise

**Total: 45**

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

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

# SEMESTER IV

## MA1254 – STATISTICS AND NUMERICAL METHODS

(Common to Automobile, Mechanical and Production)

L	T	P	C
3	1	0	4

### UNIT I TESTING OF HYPOTHESIS 9

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

### UNIT II DESIGN OF EXPERIMENTS 9

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

### UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

Newton-Raphson method – Gauss elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix inversion by Gauss-Jordan method – Eigen values of a matrix by power method .

### UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9

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

### UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9

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

**L: 45 T: 15 Total: 60**

### TEXT BOOKS

1. Johnson, R.A. and Gupta, C.B., "Miller and Freund's Probability and Statistics for Engineers", 7th Edition, Pearson Education Asia, 2007.
2. Grewal, B.S. and Grewal, J.S., "Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, 2004.

### REFERENCES

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



### **TEXT BOOKS**

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

### **REFERENCES**

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





## **EC1265 – ELECTRONICS AND MICROPROCESSORS**

(Common to Automobile, Mechanical and Production)

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

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

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

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

Bipolar junction transistor – CB, CE, CC configuration and characteristics – Biasing circuits – Class A, B and C amplifiers – Field effect transistor – Configuration and characteristic of FET amplifier – SCR, diac, triac, UJT – Characteristics and simple applications – Switching transistors – Concept of feedback – Negative feedback – Application in temperature and motor speed control.

### **UNIT III DIGITAL ELECTRONICS 9**

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

### **UNIT IV 8085 MICROPROCESSOR 9**

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

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

Basic interfacing concepts – Interfacing of input and output devices – Applications of microprocessor temperature control – Stepper motor control – Traffic light control.

**Total: 45**

#### **TEXT BOOKS**

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

#### **REFERENCES**

1. Malvino and Leach, “Digital Principles and Applications”, Tata McGraw-Hill, 1996.
2. Mehta, V.K., “Principles of Electronics”, S. Chand and Company Ltd, 1994.
3. Hall, D.V., “Microprocessor and Interfacing, Programming and Hardware”, Tata McGraw-Hill, 1999.

## AT1252 – AUTOMOTIVE CHASSIS

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

### **UNIT I INTRODUCTION 9**

Types of chassis layout – With reference to power plant location and drive – Various types of frames – Loads acting on vehicle frame – Constructional details and materials for frames – Testing of frames – Types of front axles and stub axles – Front wheel geometry – Castor – Camber – King pin inclination and Toe-in – Condition for true rolling motion of wheels during steering – Ackerman's and Daut's steering mechanisms – Steering error curve – Steering linkages – Different types of steering gears – Slip angle – Over-steer and under-steer – Reversible and irreversible steering – Power-assisted steering.

### **UNIT II DRIVE LINE 9**

Effect of driving thrust, torque reactions and side thrust – Hotchkiss drive – Torque tube drive – Radius rods and stabilizers – Propeller shaft – Universal joints – Constant velocity universal joints – Front wheel drive – Final drive – Different types – Double reduction and twin speed final drives – Multi-axled vehicles – Differential principle and types – Differential housings – Non-slip differential – Differential locks – Final drive of crawler tractors.

### **UNIT III AXLES 9**

Construction and design of drive axles – Types of loads acting on drive axles – Full, floating, three-quarter floating and semi-floating axles – Axle housings and types – Types and constructional details of different types of wheels and rims – Different types of tyres and their constructional details.

### **UNIT IV SUSPENSION SYSTEM 9**

Need for suspension system – Types of suspension springs – Constructional details and characteristics of single leaf, multi-leaf, coil, torsion bar, rubber, pneumatic and hydro-elastic suspension spring systems – Independent suspension system – Shock absorbers – Types and constructional details – Design of leaf and coil springs.

### **UNIT V BRAKING SYSTEM 9**

Theory of automobile braking – Stopping distance time and braking efficiency – Effect of weight transfer during braking – Theory of drum brakes – Leading and trailing shoes – Braking torque – Constructional details of drum brake and its activators – Disc brake theory – Types and construction – Hydraulic braking system – Mechanical braking system – Pneumatic braking system – Power-assisted braking system – Servo brakes – Retarders – Types and construction – Anti-lock braking system – Constructional details.

**Total: 45**

### **TEXT BOOKS**

1. Kripal Singh, "Automobile Engineering", Standard Publishers, 2007.
2. Giri, N.K., "Automotive Mechanics", Khanna Publishers, 2005.

### **REFERENCES**

1. Heldt, P.M., "Automotive Chassis", Chilton Co., 2000.
2. Newton Steeds and Garret, "Motor Vehicles", 13th Edition, Butterworth, 2005.
3. Heinz Hazler, "Modern Vehicle Technology", Butterworth, 2005.

**L T P C**  
**0 0 3 2****LIST OF EXPERIMENTS**

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

**LIST OF EQUIPMENTS**

(for a batch of 30 students)

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

**Total: 45**

## **ME1255 – COMPUTER AIDED MACHINE DRAWING LABORATORY**

(Common to Automobile and Production)

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

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

**Total: 45**

### **LIST OF EQUIPMENTS**

(for a batch of 30 students)

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

## EC1266 – ELECTRONICS AND MICROPROCESSORS LABORATORY

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

### LIST OF EXPERIMENTS

#### **ELECTRONICS**

**30**

VI Characteristics of PN Junction Diode

VI Characteristics of Zener Diode

Characteristics of CE Transistor

Characteristics of JFET

Characteristics of Uni Junction Transistor

RC or Wein Bridge Oscillator

Study of Logic Gates (Basic Gates)

Half Adder and Full Adder

Shift Registers and Counters

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

#### **MICROPROCESSORS**

**15**

Block Transfer

8 bit Addition, Subtraction

Multiplication and Division

Maximum and Minimum of block of data

Sorting

Stepper Motor Interfacing

### LIST OF EQUIPMENTS

(for a batch of 30 students)

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

**Total: 45**

## CE1260 – STRENGTH OF MATERIALS LABORATORY

(Common to Automobile, Mechanical and Production)

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

### LIST OF EXPERIMENTS

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

### LIST OF EQUIPMENTS

(for a batch of 30 students)

Universal Tensile Testing machine with double shear attachment – 40 Ton Capacity	1 No.
Torsion Testing Machine (60 NM Capacity)	1 No.
Impact Testing Machine (300 J Capacity)	1 No.
Brinell Hardness Testing Machine	1 No.
Rockwell Hardness Testing Machine	1 No.
Spring Testing Machine for tensile and compressive loads (2500 N)	1 No.
Metallurgical Microscopes	3 Nos.
Muffle Furnace (800 °C)	

**Total: 45**

## SEMESTER V

### HS1201 – ENVIRONMENTAL SCIENCE AND ENGINEERING

(Common to Aeronautical, Automobile, Marine, Mechanical and Production)

L	T	P	C
3	0	0	3

#### UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation – Deforestation – Case studies – Timber extraction, mining, dams and their ground water – Floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: use effects on forests and tribal people – Water resources: use and over-utilization of surface and exploitation – Environmental effects of extracting and using mineral resources – Case studies – Food resources: World food problems – Changes caused by agriculture and overgrazing – Effects of modern agriculture – Fertilizer-pesticide problems – Water logging – Salinity – Case studies – Energy resources: growing energy needs, renewable and non renewable energy sources – Use of alternate energy sources – Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles – Field study of local area to document environmental assets – River / forest / grassland / hill / mountain.

#### UNIT II ECOSYSTEMS AND BIODIVERSITY 14

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity – Definition: Genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: Habitat loss, poaching of wildlife and man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

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

#### UNIT III ENVIRONMENTAL POLLUTION 8

Definition – Causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards – Solid waste management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / rural / industrial / agricultural.

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

**7**

From unsustainable to sustainable development – Urban problems related to energy – Water conservation – Rain water harvesting – Watershed management – Resettlement and rehabilitation of people; Its problems and concerns – Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust – Case studies – Wasteland reclamation – Consumerism and waste products – Environment protection act – Air (prevention and control of pollution) act – Water (prevention and control of pollution) act – Wildlife protection act – Forest conservation act – Issues involved in enforcement of environmental legislation – Public awareness.

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

**6**

Population growth – Variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health – Case studies.

**Total: 45**

#### **TEXT BOOKS**

1. Masters, G. M., “Introduction to Environmental Engineering and Science”, 2nd Edition, Pearson Education Pvt. Ltd., 2004.
2. Trivedi R.K. and Goe P.K., “Introduction to Air Pollution”, Techno-Science Publications, 2003.

#### **REFERENCES**

1. Bharucha Erach, “The Biodiversity of India”, Mapin Publishing Pvt. Ltd., India,
2. Cunningham, Cooper W.P and Gorhani T.H., “Environmental Encyclopedia”, Jaico Publications, 2001.
3. Wager K.D., “Environmental Management”, W.B. Saunders Co., Philadelphia, 1998.



## AT1302 – AUTOMOTIVE ENGINES COMPONENTS DESIGN

L	T	P	C
3	1	0	4

### UNIT I INTRODUCTION 9

Engineering materials and their physical properties applied to design – Selection of materials – Factor of safety – Endurance limit – Notch sensitivity – Principles of design optimization – Future trends – Computer aided drafting.

### UNIT II LIMITS, FITS, TOLERANCES, SURFACE FINISH, SHAFTS AND SPRINGS 9

Definitions – Types of tolerances and fits – Design considerations for interference fits – Surface finish – Surface roughness – Design of power transmission shafts – Design of helical springs.

### UNIT III DESIGN OF CYLINDER AND PISTON 9

Choice of material for cylinder and piston – Piston friction – Piston slap – Design of cylinder – Piston – Piston pin – Piston rings – Piston failures – Lubrication of piston assembly.

### UNIT IV DESIGN OF CONNECTING ROD, CRANKSHAFT 9

Material for connecting rod – Determining minimum length of connecting rod – Small end and big end design – Shank design – Design of big end cap bolts – Connecting rod failures – Balancing of I.C. Engines – Significance of firing order – Material for crankshaft – Design of crankshaft under bending and twisting – Balancing weight calculations.

### UNIT V DESIGN OF VALVES AND FLYWHEEL 9

Design aspects of intake and exhaust manifolds – Inlet and Exhaust valves – Valve springs – Tappets – Valve train – Materials and design of flywheel.

**L: 45 T: 15 Total: 60**

### TEXT BOOKS

1. Jain R.K., “Machine Design”, Khanna Publishers, 1997.
2. “Design Data Book”, PSG College of Technology, 2000.

### REFERENCES

1. Heldt P.M., “High Speed Combustion Engines”, Oxford-IBH Publishing Co., 1965.
2. Kolchin A. and Demidov V., “Design of Automotive Engines”, MIR Publishers, 1984.
3. Sundararaja Murthy T.V., “Machine Design”, Khanna Publishers, 1991.

## AT1303 – FUELS AND LUBRICANTS

L	T	P	C
3	0	0	3

### UNIT I MANUFACTURE OF FUELS AND LUBRICANTS 9

Structure of petroleum – Refining process – Fuels – Thermal cracking – Catalytic cracking – Polymerization – Alkylation – Isomerisation – Blending – Products of refining process – Manufacture of lubricating oil base stocks – Manufacture of finished automotive lubricants.

### UNIT II THEORY OF LUBRICATION 9

Engine friction: Introduction – Total engine friction – Effect of engine variables on friction – Hydrodynamic lubrication – Elasto hydrodynamic lubrication – Boundary lubrication – Bearing lubrication – Functions of the lubrication system – Introduction to design of a lubricating system.

### UNIT III LUBRICANTS 9

Specific requirements for automotive lubricants – Oxidation deterioration and degradation of lubricants – Additives and additive mechanism – Synthetic lubricants – Classification of lubricating oils – Properties of lubricating oils – Tests on lubricants – Grease – Classification – Properties – Test used in grease.

### UNIT IV PROPERTIES AND TESTING OF FUELS 9

Thermo – Chemistry of fuels – Properties and testing of fuels – Relative density – Calorific value – Distillation – Vapour pressure – Flash point – Spontaneous ignition temperature – Viscosity – Pour point – Flammability – Ignitability – Diesel index – API gravity – Aniline point etc.

### UNIT V COMBUSTION & FUEL RATING 9

SI Engines – Flame propagation and mechanism of combustion – Normal combustion – Knocking – Octane rating – Fuel requirements – CI engine – Mechanism of combustion – Diesel knocks – Cetane rating – Fuel requirements – Additive – Mechanism – Requirements of an additive – Petrol fuel additives and diesel fuel additives – Specifications of fuels.

**Total: 45**

### TEXT BOOKS

1. Ganesan.V., “Internal Combustion Engineering”, Tata McGraw-Hill Publishing Co., 2003.
2. Mathur M.L., Sharma R.P., “A Course in Internal Combustion Engines”, Dhanpatrai publication, 2003.

### REFERENCES

1. Brame, J.S.S. and King, J.G., “Fuels, Solids, Liquids, Gaseous”.
2. Francis, W, “Fuels and Fuel Technology”, Vol. I & II.
3. Hobson, G.D. and Pohl.W, “Modern Petroleum Technology”.

# ME1304 – ENGINEERING METROLOGY AND MEASUREMENTS

(Common to Mechanical and Automobile)

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

## **UNIT I CONCEPT OF MEASUREMENT 9**

General concept – Generalized measurement system – Units and standards – Measuring instruments – Sensitivity, readability, range of accuracy, precision-static and dynamic response – Repeatability – Systematic and random errors – Correction, calibration, interchangeability and limit gauges.

## **UNIT II LINEAR AND ANGULAR MEASUREMENT 9**

Definition of metrology – Linear measuring instruments: Vernier, micrometer, interval measurement, slip gauges and classification – Interferometry – Optical flats – Comparators: Mechanical, pneumatic and electrical types – applications.

Angular measurements: Sine bar, optical bevel protractor, angle decker – Taper measurements.

## **UNIT III FORM MEASUREMENT 9**

Measurement of screw threads – Thread gauges – Floating carriage micrometer – Measurement of gears – Tooth thickness – Constant chord and base tangent method – Gleason gear testing machine – Radius measurements – Surface finish, straightness, flatness and roundness measurements.

## **UNIT IV LASER AND ADVANCES IN METROLOGY 9**

Precision instruments based on laser – Principles – Laser interferometer – Application in linear, angular measurements and machine tool metrology – Tool makers microscope – Optical profile projector.

Coordinate Measuring Machine (CMM) – Constructional features – Types, applications – Digital devices – Computer aided inspection – Vision system.

## **UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE RELATED PROPERTIES 9**

Force – Torque – Power: Mechanical, pneumatic, hydraulic and electrical type – Flow measurement: Venturi, orifice, rotameter, pitot tube – Temperature: bimetallic strip, pressure thermometers, thermocouples and electrical resistance thermister – Pyrometers.

**Total: 45**

### **TEXT BOOKS**

1. Jain R.K., “Engineering Metrology”, Khanna Publishers, 1994.
2. Morris, A.S., “The Essence of Measurement”, Prentice Hall of India, 1997.

### **REFERENCES**

1. Gupta S.C, “Engineering Metrology”, Dhanpat Rai Publications, 1984.
2. Jayal A.K, “Instrumentation and Mechanical Measurements”, Galgotia Publications 2000.
3. Beckwith T.G, and N. Lewis Buck, “Mechanical Measurements”, Addison Wesley, 1991.
4. Eckman, D.D., “Industrial Instrumentation”, Wiley Eastern, 1985.



## AT1305 – AUTO ELECTRICAL AND ELECTRONICS LABORATORY

L	T	P	C
0	0	3	2

### a. **Electrical Laboratory**

1. Testing of batteries and battery maintenance
2. Testing of starting motors and generators
3. Testing of regulators and cut – outs
4. Diagnosis of ignition system faults
5. Study of Automobile electrical wiring

### b. **Electronics Laboratory**

6. Study of rectifiers and filters
7. Study of logic gates, adder and flip-flops
8. Study of SCR and IC timer
9. Interfacing A/D converter and simple data acquisition
10. Micro controller programming and interfacing

**Total: 45**

### **LIST OF EQUIPMENTS**

(for a batch of 30 students)

- |       |  |              |
|-------|--|--------------|
| i.    | Battery, hydrometer, voltage tester    | - 1 No. each |
| ii.   | Starter motor, regulator, cut-out      | - 1 No. each |
| iii.  | Distributor, ignition coil, spark plug | - 1 No. each |
| iv.   | Auto electrical wiring system          | - 1 No.      |
| v.    | Rectifiers, filters                    | - 1 No. each |
| vi.   | Amplifier                              | - 1 No.      |
| vii.  | IC timer                               | - 1 No.      |
| viii. | Data logger                            | -1 No.       |

**LIST OF EXPERIMENTS**

**Study and measurement of the following chassis frames:**

1. Heavy duty vehicle frame (Leyland, Tata etc)
2. Light duty vehicle frame (Ambassador, Maruti van etc)

**Study, dismantling and assembling of**

3. Front Axle
4. Rear Axle
5. Differential
6. Steering systems along with any two types of steering gear box
7. Braking systems – hydraulic servo vacuum, compressed air power brakes.
8. Leaf spring, coil spring, torsion bar spring, Hydraulic shock absorber

**Study, Dismantling and Assembling of**

9. Clutch assembly of different types
10. Gear Box
11. Transfer case

**Total: 45**

**LIST OF EQUIPMENTS**

(for a batch of 30 students)

- |  |              |
|--|--------------|
| 1. Heavy duty vehicle chassis frame (Leyland or Tata)            | - 1 No.      |
| 2. Light duty vehicle chassis frame                              | - 1 No.      |
| 3. Front axle  | - 1 No.      |
| 4. Rear axle   | - 1 No.      |
| 5. Steering system   | - 1 No.      |
| 6. Steering gear box (Rack and pinion, re-circulating ball type) | - 1 No. each |
| 7. Hydraulic brake system  | - 1 No.      |
| 8. Air brake system  | - 1 No.      |
| 9. Leaf spring, coil spring, torsion bar                         | - 1 No. each |
| 10. Hydraulic shock absorber                                     | - 1 No.      |
| 11. Diaphragm clutch assembly                                    | - 1 No.      |
| 12. Gear box (light duty, heavy duty)                            | - 1 No. each |
| 13. Transfer case  | - 1 No.      |

## AT1307 – FUELS AND LUBRICANTS LABORATORY

L	T	P	C
0	0	3	2

1. Temperature dependence of viscosity of lubrication oil by Redwood Viscometer.
2. Viscosity Index of lubricating oil by Say-bolt Viscometer
3. Flash and Fire points of fuels.
4. Flash and Fire points of lubricants.
5. ASME distillation test of gasoline
6. Drop point of grease and mechanical penetration in grease.
7. Aniline distillation test of gasoline
8. Calorific value of liquid fuel.
9. Calorific value of gaseous fuel.
10. Reid vapour pressure test.

**Total: 45**

# SEMESTER VI

## MG1351 – PRINCIPLES OF MANAGEMENT

(Common to Aeronautical, Automobile, Marine, Mechanical and Production)

L	T	P	C
3	0	0	3

### UNIT I HISTORICAL DEVELOPMENT 9

Definition of management – Science or art – Management and administration – Development of management thought – Contribution of Taylor and Fayol – Functions of management – Types of business organization.

### UNIT II PLANNING 9

Nature and purpose – Steps involved in planning – Objectives – Setting objectives – Process of managing by objectives – Strategies, policies and planning premises – Forecasting – Decision-making.

### UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Structure and process – Departmentation by difference strategies – Line and staff authority – Benefits and limitations – Decentralization and delegation of authority – Staffing – Selection process – Techniques – HRD – Managerial effectiveness.

### UNIT IV DIRECTING 9

Scope – Human factors – Creativity and innovation – Harmonizing objectives – Leadership – Types of leadership motivation – Hierarchy of needs – Motivation theories – Motivational techniques – Job enrichment – Communication – Process of communication – Barriers and breakdown – Effective communication – Electronic media in communication.

### UNIT V CONTROLLING 9

System and process of controlling – Requirements for effective control – The budget as control technique – Information technology in controlling – Use of computers in handling the information – Productivity – Problems and management – Control of overall performance – Direct and preventive control – Reporting – The global environment – Globalization and liberalization – International management and global theory of management.

**Total: 45**

### TEXT BOOKS

1. Harold Koortz and Heinz Wehrich, “Essentials of Management”, Tata McGraw-Hill, 1998.
2. Massie, J.L., “Essentials of Management”, 4th Edition, Prentice Hall of India, 2003.

### REFERENCES

1. Tripathy P.C and Reddy P.N., “Principles of Management”, Tata McGraw-Hill, 1999.
2. Decenzo David, Robbin Stephen A, “Personnel and Human Resources Management”, Prentice Hall of India, 1996.
3. JAF Stomer, Freeman R. E and Gilbert, D.R., “Management”, 6th Edition, Pearson Education, 2004.
4. Fraidon Mazda, “Engineering Management”, Addison Wesley, 2000.

## **AT1351 – AUTOMOTIVE CHASSIS DESIGN**

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

### **UNIT I CLUTCH DESIGN CALCULATION 9**

Design of single plate clutch – Multi plate clutch – Design of centrifugal clutch – Cone clutch – Energy dissipated – Torque capacity of clutch – Design of clutch components – Design details of roller and sprag type of clutches.

### **UNIT II GEAR BOX 9**

Performance of vehicle – Total resistance to motion – Traction and tractive effort – Acceleration – Calculation of gear ratio – Design of three speed gear box – Design of four speed gear boxes.

### **UNIT III VEHICLE FRAME AND SUSPENSION 9**

Study of loads, moments and stresses on frame members – Computer aided design of frame for passenger and commercial vehicles – Computer aided design of leaf springs – Coil springs and torsion bar springs.

### **UNIT IV FRONT AXLE AND STEERING SYSTEMS 9**

Analysis of loads, moments and stresses at different sections of front axle – Determination of loads at kingpin bearings – Wheel spindle bearings – Choice of bearings – Determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.

### **UNIT V FINAL DRIVE AND REAR AXLE 9**

Design of propeller shaft – Design details of final drive gearing – Design details of full floating – Semi-floating and three quarter floating rear shafts and rear axle housings.

**L: 45 T: 15 Total: 60**

### **TEXT BOOK**

1. Giri. N.K, “Automobile Mechanics”, Khanna Publisher, 2002.

### **REFERENCES**

1. Heldt. P.M., “Automotive Chassis”, Chilton Co., 1992.
2. Steeds. W., “Mechanics of Road Vehicles”, Illiffe Books Ltd., 1990.
3. Giles. K.G., “Steering, Suspension and Tyres”, Illiffe Books Ltd., 1988.
4. Newton Steeds and Garret., “Motor Vehicle”, Illiffe Books Ltd., 2000.
5. Heldt. P.M., “Torque converter”, Chilton Book Co., 1982.
6. Dean Aaverns., “Automobile Chassis Design”, Illiffe Books Ltd, 1992.

## AT1352 – COMPUTER AIDED VEHICLE DESIGN CHARACTERISTICS

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

### **UNIT I INTRODUCTION 9**

Study and selection of vehicle specifications – Choice of Cycle, fuel, speed, cylinder arrangement, number of cylinders, method of cooling, material, design variables and operating variables affecting performance and emission.

### **UNIT II PERFORMANCE CURVES 9**

Residence, power and torque curve – Driving force against vehicle speed – Acceleration and gradability in different gears for a typical car or truck plotted from specifications.

### **UNIT III RESISTENCE TO VEHICLE MOTION 9**

Calculation and plotting the curves of air, rolling and gradient resistances – Driving force – Engine power, speed, rear axle ratio, torque and mechanical efficiency at different vehicle speeds.

### **UNIT IV ENGINE DESIGN 9**

Pressure volume diagram – Frictional mean effective pressure – Engine capacity – Calculation of bore and stroke length – Velocity and acceleration – Gas force – Inertia and resultant force at various crank angles – Side thrust on cylinder walls.

### **UNIT V GEAR RATIOS 9**

Determination of gear ratios, acceleration and gradability - Typical problems.

**L: 45 T: 15 Total: 60**

### **TEXT BOOKS**

1. Giri. N.K., “Automobile Mechanics” Khanna Publishers, 2002.
2. Heldt P.M., “High Speed Combustion Engine”, Oxford and IBH Publishing Co., 1989.

### **REFERENCE**

1. Lichty., “IC Engines”, Kogakusha Co., Ltd., 1991.

## AT1353 – AUTOMOTIVE POLLUTION AND CONTROL

L	T	P	C
3	0	0	3

### UNIT I INTRODUCTION 9

Vehicle population assessment in metropolitan cities and contribution to pollution – Effects on human health and environment – Global warming – Types of emission – Transient operational effects on pollution.

### UNIT II POLLUTANT FORMATION IN SI ENGINES 9

Pollutant formation in SI Engines – Mechanism of HC and CO formation in four stroke and two stroke SI engines – NO<sub>x</sub> formation in SI engines – Effects of design and operating variables on emission formation – Control of evaporative emission – Two stroke engine pollution.

### UNIT III POLLUTANT FORMATION IN CI ENGINES 9

Pollutant formation in CI engines – Smoke and particulate emissions in CI engines – Effects of design and operating variables on CI engine emissions – NO<sub>x</sub> formation and control – Noise pollution from automobiles, measurement and standards.

### UNIT IV CONTROL OF EMISSIONS FROM SI AND CI ENGINES 9

Design of engine – Optimum selection of operating variables for control of emissions – EGR – Thermal reactors – Secondary air injection – Catalytic converters – Catalysts – Fuel modifications – Fuel cells – Two stroke engine pollution control.

### UNIT V MEASUREMENT TECHNIQUES EMISSION STANDARDS AND TEST PROCEDURE 9

NDIR – FID – Chemiluminescent analyzers – Gas Chromatograph – Smoke meters – Emission standards – Driving cycles – Euro in USA, Japan and India – Test procedures – ECE, FTP Tests – SHED Test – Chassis dynamometers – Dilution tunnels.

**Total: 45**

### TEXT BOOKS

1. Paul Degobert, “Automobiles and Pollution”, SAE International, 1991.
2. Ganesan, V., “Internal Combustion Engines”, Tata McGraw-Hill Co., 2003.

### REFERENCES

1. SAE Transactions, “Vehicle Emission”, 1982.
2. Obert.E.F., “Internal Combustion Engines”, 1988.
3. Marco Nute, “Emissions from two stroke engines”, SAE Publication, 1998.

## AT1354 – AUTOMOTIVE TRANSMISSION

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

### **UNIT I      GEAR BOX AND FLUID COUPLING      10**

Method of calculation of gear ratios for vehicles – Performance characteristics in different speeds – Different types of gear boxes – Speed synchronizing devices – Gear materials – Lubrication – Advantages and limitations – Construction details – Torque capacity – Slip in fluid coupling – Performance characteristics – Means used to reduce drag torque in fluid coupling.

### **UNIT II      SPUR GEARS      7**

All spur and internal gear type planetary gearboxes – Ford T-model, Cotal and Wilson Gear box – Determination of gear ratios – Automatic overdrives.

### **UNIT III      TORQUE CONVERTERS      8**

Principal of torque conversion in single, multi stage and polyphase torque converters – Performance characteristics – Constructional and operational details of typical hydraulic transmission drives (e.g.) Leyland, White hydro torque drives.

### **UNIT IV      TRANSMISSION SYSTEMS      10**

Automatic transmission: Relative merits and demerits when compared to conventional transmission – Automatic control of gears – Study of typical automatic transmissions – Ford and Chevrolet drive – Automatic control of gear box.

### **UNIT V      DRIVES      10**

Hydrostatic drives: Advantages and disadvantages – Principles of hydrostatic drive systems – Construction and working of typical hydrostatic drives – Janney hydrostatic drive.

Electrical drives: Advantages and limitations – Principles of ward leonard system of control modern electric drive for buses and performance characteristics.

**Total: 45**

### **TEXT BOOKS**

1. Heldt P.M., “Torque converters”, Chilton Book Co., 1992.
2. Newton and Steeds., “Motor Vehicle”, Illiff Publisher, 2000.

### **REFERENCE**

1. Design Practices., “Passenger Car Automotive Transmissions”, SAE Hand book, 1994.

## AT1355 – RE-CONDITIONING LABORATORY

L	T	P	C
0	0	3	2

1. Cylinder reboring – checking the cylinder bore.
2. Setting the tool and reboring.
3. Valve grinding, valve lapping.
4. Setting the valve angle and checking for valve leakage
5. Calibration of fuel injection pump
6. Wheel alignment – testing of camber, caster.
7. Testing kingpin inclination, toe-in and toe-out.
8. Chassis alignment testing
9. Brake adjustment
10. Brake bleeding.

**Total: 45**

### LIST OF EQUIPMENTS

(for a batch of 30 students)

- |   |         |
|---|---------|
| 1. Cylinder reboring machine                                | - 1 No. |
| 2. Valve grinding machine                                   | - 1 No. |
| 3. Valve lapping machine                                    | - 1 No. |
| 4. Fuel injection calibration test bench with nozzle tester | - 1 No. |
| 5. Wheel alignment apparatus                                | - 1 No. |

## AT1356 – COMPUTER AIDED ENGINE DESIGN LABORATORY

L	T	P	C
0	0	3	2

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

**Total: 45**

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

1. Computer nodes - 30 Nos.
2. Software like AutoCAD or Pro-E - 15 licenses

## AT1357 – COMPUTER AIDED CHASSIS DESIGN LABORATORY

L	T	P	C
0	0	3	2

### CLUTCH

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

### GEAR BOX

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

**Total: 45**

### LIST OF EQUIPMENTS

(for a batch of 30 students )

1. Computer nodes - 30 Nos.
2. Software like AutoCAD or Pro-E - 15 licenses

## SEMESTER VII

### MG1301 – TOTAL QUALITY MANAGEMENT

(Common to Aeronautical, Automobile, Marine, Mechanical and Production)

L	T	P	C
3	0	0	3

#### UNIT I INTRODUCTION 9

Definition of quality – Dimensions of quality – Quality planning – Quality costs – Analysis techniques for quality costs – Basic concepts of total quality management – Historical review – Principles of TQM – Leadership – Concepts – Role of senior management – Quality council – Quality statements – Strategic planning – Deming philosophy – Barriers to TQM implementation.

#### UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer perception of quality – Customer complaints – Service quality – Customer retention – Employee involvement – Motivation, empowerment, teams, recognition and reward – Performance appraisal – Benefits – Continuous process improvement – Juran trilogy – PDCA cycle – 5S – Kaizen – Supplier partnership – Partnering – Sourcing – Supplier selection – Supplier rating – Relationship development – Performance measures – Basic concepts – Strategy – Performance measure.

#### UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality – Statistical fundamentals – Measures of central tendency and dispersion – Population and sample – Normal curve – Control charts for variables and attributes – Process capability – Concept of six sigma – New seven management tools.

#### UNIT IV TQM TOOLS 9

Benchmarking – Reasons to benchmark – Benchmarking process – Quality Function Deployment (QFD) – House of quality – QFD process – Benefits – Taguchi quality loss function – Total Productive Maintenance (TPM) – Concept – Improvement needs – FMEA – Stages of FMEA.

#### UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and other quality systems – ISO 9000:2000 Quality system – Elements – Implementation of quality system – Documentation – Quality auditing – TS 16949 – ISO 14000 – Concept – Requirements and benefits.

**Total: 45**

#### TEXT BOOK

1. Besterfield, D.H. et al., “Total Quality Management”, Pearson Education, Inc. 2003.

#### REFERENCES

1. Evans, J. R., and Lidsay, W.M., “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., “Total Quality Management”, McGraw Hill, 1991.
3. Oakland.J.S. “Total Quality Management”, Butterworth – Heinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan, N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
5. Zeiri., “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

**ME1401 – FINITE ELEMENT ANALYSIS**  
(Common to Mechanical and Automobile)

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

**UNIT I INTRODUCTION 9**

Historical background – Matrix approach – Application to the continuum – Discretisation – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method.

**UNIT II ONE DIMENSIONAL PROBLEMS 9**

Finite element modeling – Coordinates and shape functions – Potential energy approach – Galarkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses.

**UNIT III TWO DIMENSIONAL CONTINUUM 9**

Introduction – Finite element modelling – Scalar valued problem – Poisson equation – Laplace equation – Plane stress and plane strain conditions – Triangular elements – Element stiffness matrix – Force vector – Galarkin approach – Stress calculation – Temperature effects – Dynamics – Mass matrixes.

**UNIT IV AXISYMMETRIC CONTINUUM 9**

Axi-symmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures – Rotating discs.

**UNIT V ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUUM 9**

Isoperimetric formulation – The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration – Element stiffness matrix – Stress calculations – Four node quadrilaterals for axi-symmetric problems.

**L: 45 T: 15 Total: 60**

**TEXT BOOKS**

1. Chandrupatla T.R., and Belegundu A.D., “Introduction to Finite Elements in Engineering”, 3rd Edition, Pearson Education, 2002.
2. Hutton, D.V., “Fundamentals of Finite Element Analysis”, McGraw-Hill International Edition, 2004.

**REFERENCES**

1. Rao S.S., “The Finite Element Method in Engineering”, Pergammon Press, 1989.
2. Logan D.L., “A First course in the Finite Element Method”, 3rd Edition, Thomson Learning, 2002.
3. Cook, R.D., David.S, Plesha, MME., “Concepts and Applications of Finite Element Analysis” 4th Edition, 2003.
4. Reddy J.N., “An Introduction to Finite Element Method”, McGraw-Hill International Student Edition, 1985.





## **AT1403 – VEHICLE MAINTENANCE LABORATORY**

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

1. Study and layout of an automobile repair, service and maintenance shop.
2. Study and preparation of different statements/records required for the repair and maintenance works.
3. Study and preparation of the list of different types of tools and instruments require.
4. Minor and major tune up of gasoline and diesel engines.
5. Fault diagnosis in electrical ignition system, gasoline fuel system, diesel fuel system and rectification.
6. Study of the electrical systems such as head lights, side or parking lights, trafficator lights, electric horn system, windscreen wiper system, starter system and charging system.
7. Study and checking of wheel alignment.
8. Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.
9. Practice the following:
  - i) Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play.
  - ii) Air bleeding from hydraulic brakes, air bleeding of diesel fuel system.
  - iii) Wheel bearings tightening and adjustment.
10. Practice the following
  - i) Adjustment of head lights beam.
  - ii) Removal and fitting of tyre and tube.

**Total: 45**

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

- |     |   |         |
|-----|---|---------|
| 1.  | Engine Analyzer                           | - 1 No. |
| 2.  | Cylinder compression pressure gauge       | - 1 No. |
| 3.  | Vacuum gauge                              | - 1 No. |
| 4.  | Spark plug cleaner and tester             | - 1 No. |
| 5.  | Cam angle and rpm tester                  | - 1 No. |
| 6.  | Tachometer                                | - 1 No. |
| 7.  | Wheel alignment apparatus                 | - 1 No. |
| 8.  | Gas welding equipment                     | - 1 No. |
| 9.  | Tyre remover                              | - 1 No. |
| 10. | Bearing puller                            | - 1 No. |
| 11. | Head light alignment gauge                | - 1 No. |
| 12. | Service manuals of petrol, diesel engines |         |

## AT1404 – COMPUTER AIDED MANUFACTURING LABORATORY

L	T	P	C
0	0	3	2

Modeling and Simulation of Manufacture of the following parts:

1. Cylinder Head.
2. Cylinder.
3. Piston.
4. Liner.
5. Piston Pin and Piston Rings.
6. Connecting Rod.
7. Crankshaft
8. Inlet and Exhaust Valves
9. Cam.
10. Cam Shaft.

**Total: 45**

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

1. Computer system - 30 Nos.
2. Software like Pro-E - 15 licenses

## HS1301 – COMMUNICATION AND SOFT SKILLS LABORATORY

L	T	P	C
0	0	3	2

The aim of the course is two-fold: to enable the students to develop communication skills in the language laboratory and to arrange discussions for developing soft skills in the lab and/or the classroom. Each lab session shall last for three periods.

### **List of activities that are to be carried out: (15 sessions x 3 periods = 45)**

Lab session # 1: Listening and speaking practice exercises with communicative functions. Learning material: the ACD of Spoken English: A Foundation Course for Speakers of Indian Languages (Orient Longman, 2008)

Lab session # 2: Practice with more advanced communicative functions. Learning material: the ACD of Spoken English: A Foundation Course for Speakers of Indian Languages (Orient Longman, 2008)

Lab session # 3: Pronunciation exercises with Oxford Advanced Learners' Dictionary of Current English or any other standard Dictionary

Lab session # 4: Making an oral presentation in English. Learning Material: Professional Presentations VCD (Cambridge University Press)

Lab session # 5: Listening to telephone conversations in English and completing the tasks. Learning material: Essential Telephoning in English ACD (Cambridge University Press)

Lab session # 6: Giving an exposure to and practice with model group discussion and interviews. Learning material: How to Prepare for Group Discussion and Interview Audio Cassette (McGraw-Hill)

Lab session # 7: Giving insights into the format and the task types in the IELTS (International English Language Testing System). Learning Material: Objective IELTS, Intermediate Level (CUP)

Lab session # 8: Understanding the format and the task types in the TOEFL (Test of English as a Foreign Language). Learning Material: Understanding the TOEFL (Educational Testing Services, Princeton)

Lab session # 9: Administering the BEC (Business English Certificate) Diagnostic Test. Learning Material: BEC Practice Materials (British Council, Chennai)

Lab session # 10: Completing the steps involved in Career, Life Planning and Change Management. Learning Material: Developing Soft Skills (Pearson Education)

Lab session # 11: Setting goals and objectives exercises. Learning Material: Developing Soft Skills (Pearson Education)

Lab session # 12: Prioritizing and time planning exercises. Learning Material: Managing Time Multimedia Program CD

Lab session # 13: Taking a Personality Typing/ Psychometric Test Learning Material: 200 Psychometric Test prepared by the CUIC, Anna University Chennai

Lab session # 14: Critical and creative thinking exercises.

Lab session # 15: Improving body language and cross-cultural communication with pictures. Learning material: Body Language (S. Chand and Co.)

For a detailed plan, refer to the topics given below;

### **UNIT I LISTENING AND SPEAKING PRACTICE IN COMMUNICATIVE FUNCTIONS**

Introductions and Meetings – Talking about Studies and/or Job – Expressing Likes and Dislikes – Describing Daily Routines and Current Activities – Talking about Past States and Events – Talking about Future Plans and Intentions – Expressing Preferences – Giving Reasons – Expressing Opinions, agreement and Disagreement – Seeking and Giving Advice – Making Suggestions.

### **UNIT II SPEAKING APPLICATIONS**

Making an Oral Presentation – Preparing the Presentation – Performing the Presentation – Beginning – Language – Visual Aids and Body Language – Voice – Ending – Questions – Telephone Conversations – Group Discussion and Interview.

### **UNIT III UNDERSTANDING AND PREPARING FOR INTERNATIONAL ENGLISH LANGUAGE EXAMINATIONS**

International English Language Testing System (IELTS) – Test of English as a Foreign Language (TOEFL) – Business English Certificate (BEC)

### **UNIT IV SOFT SKILLS (1)**

Preparing for and Dealing With Change – Motivation, Goal-Setting and Self-Esteem – Managing Time and Stress – Career and Life Planning – Team Work – Leadership Traits.

### **UNIT V SOFT SKILLS (2)**

Multiple Intelligences – Learning Styles and Personality Typing – Critical and Creative Thinking – People, Cultures and Self – Intercultural Communication.

## RESOURCES

1. Kamalesh Sadanand and Susheela Punitha, “Spoken English: A Foundation Course” for Speakers of Indian Languages, Part 2 Audio CD, Hyderabad: Orient Longman, 2008
2. Malcome Goodale, “Professional Presentations”, (VCD) New Delhi: Cambridge University Press, 2005
3. Barbara Garside and Tony Garside, Essential Telephoning in English (Audio CD), Cambridge: Cambridge University Press, 2002
4. Hari Mohan Prasad and Rajnish Mohan, “How to Prepare for Group Discussion and Interview (Audio Cassette)”, Tata McGraw-Hill Publishing
5. International English Language Testing System Practice Tests, CUP
6. Business English Certificate Materials, Cambridge University Press
7. Understanding the TOEFL. Educational Testing Services, Princeton, US
8. Interactive Multimedia Programs on Managing Time and Stress
9. Robert M. Sherfield and et al “Developing Soft Skills”, 4th Edition, New Delhi, Pearson Education, 2009.

**Total: 60**

## SEMESTER VIII

### GE1451 – ENGINEERING ECONOMICS AND COST ANALYSIS

(Common to Mechanical, Production and Automobile)

L	T	P	C
3	0	0	3

#### UNIT I INTRODUCTION TO ECONOMICS 8

Introduction to economics – Flow in an economy – Law of supply and demand – Concept of engineering economics – Engineering efficiency – Economic efficiency – Scope of engineering economics – Element of costs – Marginal cost – Marginal revenue – Sunk cost – Opportunity cost – Break-even analysis – V ratio – Elementary economic analysis – Material selection for product design selection for a product – Process planning.

#### UNIT II VALUE ENGINEERING 10

Make or buy decision – Value engineering – Function – Aims – Value engineering procedure – Interest formulae and their applications – Time value of money – Single payment compound amount factor – Single payment present worth factor – Equal payment series sinking fund factor – Equal payment series present worth factor – Equal payment series capital recovery factor – Uniform gradient series annual equivalent factor – Effective interest rate – Examples all methods.

#### UNIT III CASH FLOW 9

Methods of comparison of alternatives – Present worth method (Revenue dominated cash flow diagram) – Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Rate of return method – Examples all methods.

#### UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS 9

Replacement and maintenance analysis – Types of maintenance – Types of replacement problem – Determination of economic life of an asset – Replacement of an asset with a new asset – Capital recovery with return and concept of challenger and defender – Simple probabilistic model for items which fail completely.

#### UNIT V DEPRECIATION 9

Depreciation-Introduction – Straight line method of depreciation – Declining balance method of depreciation – Sum of the years digits method of depreciation – Sinking fund method of depreciation/annuity method of depreciation – Service output method of depreciation – Evaluation of public alternatives – Introduction – Examples – Inflation adjusted decisions – Procedure to adjust inflation – Examples on comparison of alternatives and determination of economic life of asset.

**Total: 45**

**TEXT BOOK**

1. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, 2001.

**REFERENCES**

1. Park, C.S., “Contemporary Engineering Economics”, Prentice Hall of India, 2002.
2. Newman, D.G., and Lavelle, J.P., “Engineering Economics and analysis” Engg. Press, 2002.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, 1984.
4. Grant.E.L., Ireson.W.G., and Leavenworth, R.S, “Principles of Engineering Economy”, Ronald Press, 1976.
5. Smith, G.W., “Engineering Economy”, Iowa State Press, 1973.

## **AT1455 – PROJECT WORK**

(Common to Aeronautical, Automobile, Marine, Mechanical and Production)

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>

### **OBJECTIVE**

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student shall finally produce a comprehensive report covering back round information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

The continuous assessment shall be made as prescribed by the regulation (vide clause 10.3 of Anna University regulations 2004 for B.E., B.Tech. programmes)



## AT1002 – ALTERNATE FUELS AND ENERGY SYSTEMS

L	T	P	C
3	0	0	3

### UNIT I INTRODUCTION 9

Need for alternate fuel – Availability and properties of alternate fuels – General use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas – Merits and demerits of various alternate fuels – Introduction to alternate energy sources – Like EV, hybrid, fuel cell and solar cars.

### UNIT II ALCOHOLS 9

Properties as engine fuel, alcohols and gasoline blends – Performance in SI engine – Methanol and gasoline blends – Combustion characteristics in CI engines – Emission characteristics – DME – DEE properties performance analysis – Performance in SI and CI Engines.

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

Availability of CNG – Properties – Modification required to use in engines – Performance and emission characteristics of CNG using LPG in SI and CI engines – Performance and emission of LPG – Hydrogen: Storage and handling, performance and safety aspects.

### UNIT IV VEGETABLE OILS 9

Various vegetable oils for engines – Esterification – Performance in engines – Performance and emission characteristics – Bio diesel and its characteristics.

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

Layout of an electric vehicle – Advantage and limitations – Specifications – System components – Electronic control system – High energy and power density batteries – Hybrid vehicle – Fuel cell vehicles – Solar powered vehicles.

**Total: 45**

### TEXT BOOK

1. Bechfold, R.L., “Alternative Fuels Guide Book”, SAE International Warrendale, 1997.

### REFERENCES

1. Maheswar Dayal, “Energy today and tomorrow”, I and B Horishr India, 1982.
2. Nagpal, “Power Plant Engineering”, Khanna Publishers, 1991.
3. “Alcohols as motor fuels progress in technology”, Series No.19, SAE Publication USE, 1980.





# PR1353 – QUALITY CONTROL AND RELIABILITY ENGINEERING

(Common to Automobile, Mechanical and Production)

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

## **UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 10**

Introduction – Definition of quality – Basic concept of quality – Definition of SQC – Benefits and limitation of SQC – Quality assurance – Quality cost – Variation in process – Factors – process capability – Process capability studies and simple problems – Theory of control chart – Uses of control chart – Control chart for variables – X chart R chart and  $\sigma$  chart.

## **UNIT II PROCESS CONTROL FOR ATTRIBUTES 8**

Control chart for attributes – Control chart for proportion or fraction defectives – p chart and np chart – Control chart for defects – C and U charts – State of control and process out of control identification in charts.

## **UNIT III ACCEPTANCE SAMPLING 9**

Lot by lot sampling – Types – Probability of acceptance in single, double and multiple sampling techniques – O.C. curves – Producer's risk and consumer's risk – AQL, LTPD, AOQL concepts – Standard sampling plans for AQL and LTPD – Uses of standard sampling plans.

## **UNIT IV LIFE TESTING – RELIABILITY 9**

Life testing – Objective – Failure data analysis – Mean failure rate – Mean time to failure – Mean time between failure – Hazard rate – System reliability – Series, parallel and mixed configuration – Simple problems – Maintainability and availability – Simple problems – Acceptance sampling based on reliability test – O.C Curves.

## **UNIT V QUALITY AND RELIABILITY 9**

Reliability improvements – Techniques – Use of Pareto analysis – Design for reliability – Redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

**Total: 45**

**Note:** Use of approved statistical table permitted in the examination.

### **TEXT BOOKS**

1. Grant, Eugene. L, "Statistical Quality Control", McGraw-Hill, 1996.
2. L.S.Srinath, "Reliability Engineering", Affiliated East west press, 1991.

### **REFERENCES**

1. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai and Sons, 2001.
2. R.C.Gupta, "Statistical Quality control", Khanna Publishers, 1997.
3. Besterfield D.H., "Quality Control", Prentice Hall, 1993.
4. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.
5. Danny Samson, "Manufacturing and Operations Strategy", Prentice Hall, 1991.

## MA1251 – NUMERICAL METHODS

(Common to Mechanical, Production, Automobile, and IV Semester core for Metallurgy  
Mechatronics and Aeronautical)

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

### **UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9**

Solution of equation – Fixed point iteration:  $x=g(x)$  method – Newton’s method – Solution of linear system by Gaussian elimination and Gauss – Jordan methods – Iterative methods – Gauss – Seidel methods – Inverse of a matrix by Gauss Jordan method – Eigenvalue of a matrix by power method and by Jacobi method for symmetric matrix.

### **UNIT II INTERPOLATION AND APPROXIMATION 9**

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton’s forward and backward difference formulas.

### **UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9**

Differentiation using interpolation formulae – Numerical integration by trapezoidal and Simpson’s 1/3 and 3/8 rules – Romberg’s method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and simpsons’s rules.

### **UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9**

Single step methods – Taylor series method – Euler methods for First order Runge-Kutta method for solving first and second order equations – Multistep methods – Milne’s and Adam’s predictor and corrector methods.

### **UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9**

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional laplace and poisson equations.

**L: 45 T: 15 Total: 60**

### **TEXT BOOKS**

1. Veerarjan, T. and Ramachandran, T., “Numerical Mehods with Programming in C”, 2nd Edition, Tata McGraw Hill, 2007.
2. Sankar Rao, K., “Numerical Methods for Scientisits and Engineers”, 3rd Edition, Princtice Hall of India, 2007.

### **REFERENCES**

1. Kandasamy, P., Thilagavathy, K. and Gunavathy, K., “Numerical Methods”, S.Chand Co. Ltd., 2003.
2. Gerald, C.F. and White, P.O., “Applied Numerical Analysis”, Pearson Education, 1994.

## GE1001 – INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
3	0	0	3

### UNIT I 5

Introduction – Invention and creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i. Movable Property ii. Immovable property and iii. Intellectual property).

### UNIT II 10

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial designs and integrated circuits – Protection of Geographical Indications at national and International levels – Application procedures.

### UNIT III 10

International conventions relating to intellectual property – Establishment of WIPO – Mission and activities – History – General Agreement on Trade and Tariff (GATT).

### UNIT IV 10

Indian position Vs WTO and Strategies – Indian IPR legislations – Commitments to WTO – Patent Ordinance and the Bill – Draft of a national / state Intellectual Property Policy – Present against unfair competition.

### UNIT V 10

Case studies on Patents (basumati rice, turmeric, neem, etc.) – Copyright and related rights – Trade marks – Industrial design and integrated circuits – Geographic indications – Protection against unfair competition.

**Total: 45**

### TEXT BOOK

1. Subbaram N.R., “Handbook of Indian Patent Law and Practice”, Viswanathan Publishers Pvt. Ltd., 1998.

### REFERENCES

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. “Intellectual Property Today : Volume 8”, Volume No. 5, 2001.
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.

## GE1002 – INDIAN CONSTITUTION AND SOCIETY

L	T	P	C
3	0	0	3

### UNIT I 9

Historical background – Constituent assembly of India – Philosophical foundations of the Indian constitution – Preamble – Fundamental rights – Directive principles of State Policy – Fundamental duties – Citizenship – Constitutional remedies for citizens.

### UNIT II 9

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

### UNIT III 9

State Government – Structure and functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

### UNIT IV 9

Indian Federal System – Center – State Relations – President’s rule – Constitutional amendments – Constitutional functionaries – Assessment of working of the Parliamentary System in India

### UNIT V 9

Society : Nature, Meaning and definition – Indian Social Structure – Caste, Religion, Language in India – Constitutional Remedies for citizens – Political Parties and Pressure Groups – Right of Women, Children, Scheduled Castes and Scheduled Tribes and other Weaker Sections.

**Total: 45**

### TEXT BOOKS

1. Durga Das Basu, “Introduction to the Constitution of India”, Prentice Hall of India, 1997.
2. Agarwal R.C., “Indian Political System”, S.Chand and Company, 1997.
3. Maciver and Page, “Society: An Introduction Analysis”, Mac Milan India Ltd., 1996.
4. Sharma K.L., “Social Stratification in India: Issues and Themes”, Jawaharlal Nehru University, 1997.

### REFERENCES

1. Sharma, Brij Kishore, “Introduction to the Constitution of India”, Prentice Hall of India, 1996.
2. Gahai U.R., “Indian Political System”, New Academic Publishing House, 1998.
3. Sharma R.N., “Indian Social Problems”, Media Promoters and Publishers Pvt. Ltd.
4. Yogendra Singh, “Social Stratification and Change in India’s”, Manohar, 1997.

## ELECTIVES FOR SEMESTER VII

### AT1004 – AUTOMOTIVE AERODYNAMICS

L	T	P	C
3	0	0	3

#### UNIT I INTRODUCTION 9

Scope – Historical developments – Fundamental of fluid mechanics – Flow phenomenon related to vehicles – External and Internal flow problem – Resistance to vehicle motion – Performance – Fuel consumption and performance potential of vehicle aerodynamics – Engine cooling requirement – Air flow to passenger compartment – Duct for air conditioning – Cooling of transverse engine and rear engine.

#### UNIT II AERODYNAMIC DRAG OF CARS 9

Cars as a bluff body – Flow field around car – Drag force – Types of drag force – Analysis of aerodynamic drag – Drag coefficient of cars – Strategies for aerodynamic development – Low drag profiles.

#### UNIT III SHAPE OPTIMIZATION OF CARS 9

Front end modification – Front and rear wind shield angle – Boat tailing – Hatch back – Fast back and square back – Dust flow patterns at the rear – Effects of gap configuration – Effect of fasteners.

#### UNIT IV VEHICLE HANDLING 9

The origin of forces and moments on a vehicle – Lateral stability problems – Methods to calculate forces and moments – Vehicle dynamics under side winds – The effects of forces and moments – Characteristics of forces and moments – Dirt accumulation on the vehicle – Wind noise – Drag reduction in commercial vehicles.

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

Introduction – Principle of wind tunnel technology – Limitation of simulation – Stress with scale models – Full scale wind tunnels – Measurement techniques – Equipment and transducers – Road testing methods – Numerical methods.

**Total: 45**

#### TEXT BOOK

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

#### REFERENCES

1. Pope A., “Wind Tunnel Testing”, 2nd Edition, John Wiley and Sons, 1974.
2. “Automotive Aerodynamic”, Volume 706, SAE, 1987.
3. “Vehicle Aerodynamics”, Volume 1145, SAE, 1996.



# ME1008 – COMPOSITE MATERIALS

(Common to Mechanical, Production and Automobile)

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

- UNIT I INTRODUCTION TO COMPOSITES 8**  
Fundamentals of composites – Need for composites – Enhancement of properties – classification of composites – Matrix – Polymer matrix composites (PMC) – Metal matrix composites (MMC) – Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites – Fibre reinforced composites – Applications of various types of composites.
- UNIT II POLYMER MATRIX COMPOSITES 12**  
Polymer matrix resins – Thermosetting resins – Thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – Various types of fibres – PMC processes – Hand lay up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding – Resin transfer moulding – Pultrusion – Filament winding – Injection moulding – Fibre reinforced plastics (FRP) – Glass fibre reinforced plastics (GRP).
- UNIT III METAL MATRIX COMPOSITES 9**  
Characteristics of MMC – Various types of Metal matrix composites Alloy vs MMC – Advantages of MMC – Limitations of MMC – Metal Matrix – Reinforcements – Particles – Fibres – Effect of reinforcement – Volume fraction – Rule of mixtures – Processing of MMC – Powder metallurgy process – Diffusion bonding – Stir casting – Squeeze casting.
- UNIT IV CERAMIC MATRIX COMPOSITES 9**  
Engineering ceramic materials – Properties – Advantages – Limitations – Monolithic ceramics – Need for CMC – Ceramic matrix – Various types of Ceramic Matrix composites – Oxide ceramics – Non oxide ceramics – Aluminium oxide – Silicon nitride – Reinforcements – Particles – Fibres – Whiskers – Sintering – Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).
- UNIT V ADVANCES IN COMPOSITES 7**  
Carbon/carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – Chemical vapour deposition of carbon on carbon fibre perform – Sol gel technique – Composites for aerospace applications.

**Total: 45**

## TEXT BOOKS

1. Mathews F.L. and Rawlings R.D., “Composite materials: Engineering and Science”, 1st Edition, Chapman and Hall, 1994.
2. Chawla K.K., “Composite materials”, Springer – Verlag, 1987

## REFERENCES

1. Clyne T.W. and Withers P.J., “Introduction to Metal Matrix Composites”, Cambridge University Press, 1993.
2. Strong A.B., “Fundamentals of Composite Manufacturing”, SME, 1989.
3. Sharma S.C., “Composite materials”, Narosa Publications, 2000.

## **PR1303 – DESIGN OF JIGS, FIXTURES AND PRESS TOOLS**

(Common to Mechanical, Automobile and Production)

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

### **UNIT I PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES 8**

Tool design objectives – Production devices – Inspection devices – Materials used in Jigs and Fixtures – Types of Jigs – Types of Fixtures – Mechanical actuation – Pneumatic and hydraulic actuation – Analysis of clamping force – Tolerance and error analysis.

### **UNIT II JIGS 9**

Drill bushes – Different types of jigs – Plate latch, channel, box, post, angle plate, angular post, turnover and pot jigs – Automatic drill jigs – Rack and pinion operated – Air operated Jigs components – Design and development of Jigs for given components.

### **UNIT III FIXTURES 9**

General principles of boring, lathe, milling and broaching fixtures – Grinding, planning and shaping fixtures – Assembly – Inspection and welding fixtures – Modular fixtures – Design and development of fixtures for given component.

### **UNIT IV PRESS WORKING TERMINOLOGIES, ELEMENTS OF DIES AND STRIP LAY OUT 10**

Press working terminology – Presses and press accessories – Computation of capacities and tonnage requirements – Elements of progressive combination and compound dies: Die block – Die shoe – Bolster plate – Punch plate – Punch holder – Guide pins and bushes – Strippers – Knockouts – Stops – Pilots – Selection of standard die sets strip lay out – Strip lay out calculations

### **UNIT V DESIGN AND DEVELOPMENT OF DIES 9**

Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – Development of bending dies – Forming and drawing dies – Development of drawing dies – Design considerations in forging, extrusion, casting and plastic dies

**Total: 45**

(Use of approved design data book is permitted)

### **TEXT BOOKS**

1. Edward G Hoffman, “Jigs and Fixture Design”, Thomson – Delmar Learning, 2004.
2. Donaldson. C, “Tool Design”, Tata McGraw-Hill, 1986.

### **REFERENCES**

1. Joshi, P.H., “Jigs and Fixtures”, 2nd Edition, Tata McGraw-Hill Publishing Company Limited, 2004.
2. Hiram E Grant, “Jigs and Fixture” Tata McGraw-Hill, 2003.
3. “Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983.
4. “Design Data Handbook”, PSG College of Technology, Coimbatore.

## AT1006 – COMPUTER SIMULATION OF IC ENGINE PROCESS

L	T	P	C
3	0	0	3

### UNIT I INTRODUCTION 9

Introduction – Heat of reaction – Complete combustion in C/H/O/N Systems – Constant volume adiabatic combustion – Constant pressure adiabatic combustion – Calculation of adiabatic flame temperature

### UNIT II SI ENGINE SIMULATION WITH FUEL-AIR AS WORKING MEDIUM 9

Deviation between actual and air standard cycles of operation – Problems – SI engine simulation with adiabatic constant volume combustion with fuel and air being considered – Calculation of temperature drop due to fuel vaporization – Calculation of mean effective pressure – Torque and thermal efficiency at full throttle – Part throttle and supercharged conditions.

### UNIT III ACTUAL CYCLE SIMULATION IN SI ENGINES 9

Progressive combustion: gas exchange process – Heat transfer process – Friction – Validation of the computer code with experimental data based on performance parameters and pressure crank angle diagram.

### UNIT IV SIMULATION OF 2-STROKE SI ENGINE 9

Simulation of the scavenging process – Determination of the pressure-crank angle variation – Computation of performance parameters

### UNIT V DIESEL ENGINE SIMULATION 9

Main difference between SI and CI engine simulation – Differences between ideal and actual cycles – Zero dimensional combustion model for diesel engine – Heat transfer and gas exchange processes – Performance prediction and comparison of results.

**Total: 45**

### 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.
3. Ashley Campbell, “Thermodynamic Analysis Of Combustion Engines”, John Wiley and Sons, 1986.

### REFERENCES

1. Benson.R.S. and Whitehouse. N.D., “Internal Combustion Engines”, Pergamon Press, 1979.
2. Ramoss.A.L., “Modelling of Internal Combustion Engines Processes”, McGraw-Hill Publishing Co., 1992.

# IC1404 – ROBOTICS

(Common to Mechanical, Automobile and Production)

L	T	P	C
3	0	0	3

## UNIT I FUNDAMENTALS OF ROBOT

7

Robot – Definition – Robot anatomy – Co-ordinate systems, work envelope, types and classification – Specifications – Pitch, yaw, roll, joint notations, speed of motion and pay load – Robot parts and their functions – Need for robots – Different applications

## UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS

10

Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives – D.C. servo motors, Stepper motor and A.C. servo motors – Salient features, applications and comparison of all these drives – End effectors – Grippers: Mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers, vacuum grippers – Two fingered and three fingered grippers – Internal grippers and external grippers – Selection and design considerations

## UNIT III SENSORS AND MACHINE VISION

10

Requirements of a sensor, principles and applications of the following types of sensors – Position of sensors (Piezo electric sensor, LVDT, Resolvers, Optical encoders, Pneumatic position sensors) – Range sensors (Triangulation principle, Structured, Lighting approach, Time of flight range finders, Laser range meters) – Proximity sensors (Inductive, Hall effect, Capacitive, Ultrasonic and Optical proximity sensors) – Touch sensors (Binary sensors, Analog sensors) – Wrist Sensors – Compliance Sensors – Slip Sensors

Camera, frame grabber, sensing and digitizing image data – Signal conversion – Image Storage – Lighting techniques – Image processing and analysis – Data reduction – Segmentation – Feature extraction – Object recognition – Other algorithms – Applications – Inspection, identification, visual serving and navigation.

## UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING

10

Forward kinematics – Inverse kinematics – Differences: Forward kinematics and Reverse kinematics of manipulators with two and three degrees of freedom (In 2 dimensional), four degrees of freedom (In 3 dimensional) – Deviations and problems – Teach pendant programming – Lead through programming – Robot programming Languages – VAL programming – Motion commands – Sensor commands – End effector commands – Simple programs

## UNIT V IMPLEMENTATION AND ROBOT ECONOMICS

8

RGV – AGV – Implementation of robots in industries – Various steps: Safety considerations for robot operations – Economic analysis of robots – Pay back method, EUAC method and Rate of return method.

**Total: 45**

## TEXT BOOK

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

## REFERENCES

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

# ELECTIVES FOR SEMESTER VIII

## AT1007 – TRANSPORT MANAGEMENT

L	T	P	C
3	0	0	3

### UNIT I INTRODUCTION 9

Personnel management – Objectives and functions of personnel management – Psychology – Sociology and their relevance to organization – Personality problems – Selection process: job description – Employment tests – Interviewing – Introduction to training objectives – Advantages – Methods of training – Training procedure – Psychological tests.

### UNIT II TRANSPORT SYSTEMS 9

Introduction to various transport systems – Advantages of motor transport – Principal function of administrative, traffic, secretarial and engineering divisions – Chain of responsibility – Forms of ownership by state – Municipality – Public body and private undertakings.

### UNIT III SCHEDULING AND FARE STRUCTURE 9

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

### UNIT IV MOTOR VEHICLE ACT 9

Traffic signs – Fitness certificate – Registration requirements – Permit insurance – Constructional regulations – Description of vehicle-tankers – Tippers – Delivery vans – Recovery vans – Power wagons and fire fighting vehicles – Spread over – Running time – Test for competence to drive.

### UNIT V MAINTENANCE 9

Preventive maintenance system in transport industry – Tyre maintenance procedures – Causes for uneven tyre wear – Remedies – Maintenance procedure for better fuel economy – Design of bus depot layout.

**Total: 45**

### TEXTBOOK

1. John Duke, “Fleet Management”, McGraw-Hill Co, 1984.

### REFERENCES

1. “Government Motor Vehicle Act”, Eastern Book Company, 1989
2. Kitchin.L.D., “Bus Operation”, 3rd Edition, Illiffee and Sons Co., 1992

# MG1001 – OPERATIONS RESEARCH

(Common to Mechanical and Automobile)

L	T	P	C
3	0	0	3

## UNIT I      LINEAR MODEL      9

The phases of OR study – Formation of an L.P model – Graphical solution – Simplex algorithm – Artificial variables technique – Big M method – Two phase method.

## UNIT II      TRANSPORTATION PROBLEM      9

Optimal solution by north west corner method – Least cost method – Vogels approximation method – Optimality test – MOBI method – Assignment problem – Formulation – Hungarian method – Unbalanced assignment problem.

## UNIT III      NETWORK MODELS      9

Shortest route – Minimal spanning tree – Maximum flow models – Project network – CPM and PERT network – Critical path scheduling.

## UNIT IV      REPLACEMENT MODELS      9

Replacement of items that deteriorate with time – Value of money changing with time – Not charging with time – Optimum replacement policy – Individual and group replacement – Sequencing problem: models with n jobs with 2 machines – Problem with n jobs with 3 machines.

## UNIT V      QUEUING THEORY      9

Queuing models – Queuing systems and structures – Notation – Parameter – Single server and multi-server models – Poisson input – Exponential service – Constant rate service – Infinite population.

**Total: 45**

### TEXT BOOK

1. Taha H.A., “Operation Research”, 6th Edition, Pearson Education, 2003

### REFERENCES

1. Hira and Gupta, “Introduction to Operations Research”, S.Chand and Co., 2002
2. Hira and Gupta, “Problems in Operations Research”, S.Chand and Co, 2002.
3. Panneerselvam, “Operations Research”, Prentice Hall of India, 2003.
4. Wagner, “Operations Research”, Prentice Hall of India, 2000.





**ME1011 – PRODUCT DESIGN AND COSTING**  
(Common to Mechanical, Production and Automobile)

**L T P C**  
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**UNIT I PRODUCT DESIGN AND DEVELOPMENT 8**

Principles of creativity in design – Integrated product development and concurrent engineering – Product analysis – Criteria for product design – Market research – Design for customer and design for manufacture – Product life cycle.

**UNIT II ECONOMICS OF DESIGN 9**

Breaks even point – Selection of optimal materials and processes – Material layout planning – Value analysis – Re-engineering and its impact on product development.

**UNIT III PRODUCT MODELING 9**

Product modeling – Definition of concept – Fundamental issues – Role and basic requirement of process chains and product models – Types of product models – Model standardization efforts – Types of process chains – Industrial demands

**UNIT IV PRODUCT COSTING 10**

Bill of materials – Outline Process charts – Concepts of operational standard time – Work measurement by analytical estimation and synthesis of time – Budgets times – Labor cost and material cost at every stage of manufacture – W.I.P. costing

**UNIT V RECENT ADVANCES AND CONCEPTS IN PRODUCT DESIGN 9**

Fundamentals of FEM and its significance to product design – Product life cycle management – Intelligent information system – Concept of Knowledge based product and process design.

**Total: 45**

**TEXT BOOKS**

1. Jones S.W., “Product Dosing and Process Selection”, Butterworth Publications, 1973.
2. Karl T. Ulrich, Stephen D. Eppinger, “Product Design and Development”, McGraw-Hill, 1994

**REFERENCES**

1. Sameul Eilon, “Elements of Production Planning and Control”, McMillan and Company, 1962.
2. Harry Nystrom, “Creativity and Innovation”, John Wiley and Sons, 1979
3. George E. Dieter, “Engineering Design – Materials and process approach”, Tata McGraw-Hill, 1991
4. Donald E. Carter, “Concurrent Engineering”, Addison Wesley, 1992.



## AT1010 – MODERN AUTOMOBILE ACCESSORIES

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### UNIT I ENGINE MANAGEMENT SYSTEMS 9

Electronically controlled SI and CI engine fuel injection systems – Related hardware and software – Closed loop ignition system – Catalytic converters and particulate traps.

### UNIT II CHASSIS 9

Active suspension control – Pneumatic suspensions.

### UNIT III HEATING AND AIR CONDITIONING 9

Principles of vehicle air conditioning and heating.

### UNIT IV COMFORT AND CONVENIENCE 9

Adaptive cruise control – Car entertainment – Power windows – Navigation system – Adaptive noise control – Electric seats – Driver information system – Power windows – Power steering.

### UNIT V SAFETY AND SECURITY SYSTEMS 9

Airbags – Seat belt tightening system – Collapsible and tiltable steering column – Anti theft system – Anti lock braking system – Electronic stability control system/traction control system – Roll over protection system.

**Total: 45**

### TEXT BOOKS

1. Tom Denton, “Automobile Electrical and Electronic Systems”, Edward Arnold, 1995.
2. Eric Chowanietz, “Automotive Electronics”, SAE International, 1995.

### REFERENCE

1. “Bosch Automotive Hand Book”, 5th Edition, SAE Publication, 2000.

## AT1011 – FUEL CELLS AND APPLICATIONS

L	T	P	C
3	0	0	3

### UNIT I INTRODUCTION TO FUEL CELLS 9

Introduction – Working and types of fuel cell – Low, medium and high temperature fuel cell – Liquid and methanol types – Proton exchange membrane fuel cell solid oxide – Hydrogen fuel cells – Thermodynamics and electrochemical kinetics of fuel cells.

### UNIT II FUEL CELLS FOR AUTOMOTIVE APPLICATIONS 9

Fuel cells for automotive applications – Technology advances in fuel cell vehicle systems – Onboard hydrogen storage – Liquid hydrogen and compressed hydrogen – Metal hydrides – fuel cell control system – Alkaline fuel cell – Road map to market.

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

Fuel cell performance characteristics – Current/voltage – Voltage efficiency and power density – Ohmic resistance – Kinetic performance – Mass transfer effects – Membrane electrode assembly components – Fuel cell stack – Bi-polar plate – Humidifiers and cooling plates.

### UNIT IV FUELING 9

Hydrogen storage technology – Pressure cylinders – Liquid hydrogen – Metal hydrides – Carbon fibers – Reformer technology – Steam reforming – Partial oxidation – Auto thermal reforming – CO removal – Fuel cell technology based on removal like bio-mass.

### UNIT V FUEL CYCLE ANALYSIS 9

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

**Total: 45**

### TEXTBOOKS

1. “Fuel Cells for Automotive Applications”, Professional Engineering Publishing, 2004.
2. “Fuel Cell Technology Handbook”, SAE International Gregor Hoogers CRC Press, 2003.

## **GE1301 – PROFESSIONAL ETHICS AND HUMAN VALUES**

(Common to Aeronautical, Automobile, Marine, Mechanical and Production)

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

### **UNIT I HUMAN VALUES 10**

Morals, values and ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Co-operation – Commitment – Empathy – Self-confidence – Character – Spirituality.

### **UNIT II ENGINEERING ETHICS 9**

Senses of 'Engineering Ethics' – Variety of moral issued – Types of inquiry – Moral dilemmas – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and controversy – Models of Professional Roles – Theories about right action – Self-interest – customs and religion – Uses of ethical theories.

### **UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9**

Engineering as experimentation – Engineers as responsible experimenters – Codes of ethics – A balanced outlook on law – The challenger case study

### **UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9**

Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing risk – The three mile island and Chernobyl case studies.

Collegiality and loyalty – Respect for authority – Collective bargaining – Confidentiality – Conflicts of interest – Occupational crime – Professional rights – Employee rights – Intellectual Property Rights (IPR) – Discrimination.

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

Multinational corporations – Environmental ethics – Computer ethics – Weapons development – Engineers as managers – Consulting engineers – Engineers as expert witnesses and advisors – Moral leadership – Sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.

**Total: 45**

### **TEXT BOOKS**

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, 1996.
2. Govindarajan M, Natarajan S and Senthil Kumar V. S., "Engineering Ethics", Prentice Hall of India, 2004.

### **REFERENCES**

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, 2004.
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003.
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.