

ANNA UNIVERSITY COIMBATORE

AFFILIATED INSTITUTIONS CURRICULUM 2008

B.E. AUTOMOBILE ENGINEERING

3 & 4 SEMESTERS CURRICULUM AND SYLLABI

SEMESTER – III

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

Code No.	Course Title	L	T	P	C
THEORY					
MA 2211	Transforms And Partial Differential Equations	3	1	0	4
AT 2203	Engineering Thermodynamics	3	1	0	4
ME 2204	Fluid Mechanics and Machinery	3	1	0	4
AT 2201	Automotive Engines	3	0	0	3
AE 2201	Mechanics of Machines	3	1	0	4
AT 2202	Production Technology	3	0	0	3
PRACTICAL					
AT 2205	Automotive Components Laboratory	0	0	3	2
AT 2207	Fluid Mechanics and Machinery Laboratory	0	0	3	2
AT 2206	Manufacturing Technology Laboratory	0	0	3	2

SEMESTER – IV

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

Code No.	Course Title	L	T	P	C
THEORY					
MA 2266	Statistics And Numerical Methods	3	1	0	4
AT 2251	Applied Thermodynamics and Heat Transfer	3	1	0	4
ME 2253	Engineering Materials and Metallurgy	3	0	0	3
ME 2254	Strength of Materials	3	1	0	4
ME 2255	Electronics and Micro-processors	3	0	0	3
AT 2252	Automotive Chassis	3	0	0	3
PRACTICAL					
AT 2255	Engine Performance and Emission Testing Laboratory	0	0	3	2
AT 2256	Computer Aided Machine Drawing Laboratory	0	0	4	2
AT 2257	Electronics and Micro-processors Laboratory	0	0	3	2
ME 2256	Strength of Materials Lab	0	0	3	2

SEMESTER III

(For Affiliated Colleges under R-2008)

MA 2211 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS 3 1 0 4
(Common to all branches)

OBJECTIVES

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

1. FOURIER SERIES 9 + 3

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

2. FOURIER TRANSFORMS 9 + 3

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

3. PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

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

4. APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

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

5. Z -TRANSFORMS AND DIFFERENCE EQUATIONS 9 + 3

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

Lectures : 45

Tutorials : 15

Total : 60 Periods

TEXT BOOKS

1. Grewal, B.S, '*Higher Engineering Mathematics*' 40th Edition, Khanna publishers, Delhi, (2007)

REFERENCES

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

OBJECTIVE

To achieve an understanding of principles of thermodynamics and to be able to use it in accounting for the bulk behaviour of the simple physical systems.

To provide in-depth study of thermodynamic principles, thermodynamics of state, basic thermodynamic relations, Principle of Psychrometry & Properties of pure substances

To enlighten the basic concepts of vapour power cycles.

UNIT- I: BASIC CONCEPT AND FIRST LAW**9(L)+3(T)**

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

UNIT-II: SECOND LAW, ENTROPY AND AVAILABILITY**9(L)+3(T)**

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

UNIT-III. PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE**9(L)+3(T)**

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

UNIT-IV IDEAL & REAL GASES AND THERMO DYNAMIC RELATIONS**9(L)+3(T)**

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

UNIT-V PSYCHROMETRY**9(L)+3(T)**

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

TUTORIALS**15****TOTAL : 60**

(Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant are permitted)

TEXT BOOKS

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2007.
2. Rathakrishnan E., "Fundamentals of Engineering Thermodynamics", Prentice-Hall of India, 2005.

REFERENCES

1. Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006
2. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2007.
3. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987
4. Arora C.P, " Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
5. Merala C, Pother, Craig W, Somerton, " Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.

(Common to Aeronautical, Mechanical, Automobile & Production)

Objectives:

- a. The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.
- b. The applications of the conservation laws to flow through pipes and hydraulics machines are studied

I. INTRODUCTION**12**

Units & 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 and moment of momentum equation.

II. FLOW THROUGH CIRCULAR CONDUITS**12**

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.

III. DIMENSIONAL ANALYSIS**9**

Dimension and units: Buckingham's Π theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

IV. ROTO DYNAMIC MACHINES**16**

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

V. POSITIVE DISPLACEMENT MACHINES**11**

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

TOTAL 60**TEXT BOOKS:**

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

REFERENCES:

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

OBJECTIVE

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

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 and dual cycles.

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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 and multihole nozzles, Unit injector and common rail injection systems. Injection pump calibration. Need for a governor for diesel engines. Description of a simple diesel engine governor.

UNIT-III: COMBUSTION AND COMBUSTION CHAMBERS: 13

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

UNIT-IV: SUPERCHARGING , TURBOCHARGING AND ENGINE TESTING 13

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

UNIT-V: COOLING AND LUBRICATION SYSTEMS 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 and wet sump systems. Properties of lubricants.

TEXT BOOKS:

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

REFERENCES

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

AE2201

MECHANICS OF MACHINES

3 1 0 4

(Common to Production, Automobile and Aero)

OBJECTIVE

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

UNIT- I : MECHANISMS

9+3

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

UNIT- II : FRICTION

9+3

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

UNIT- III : GEARING AND CAMS

9+3

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

UNIT-IV: BALANCING

9+3

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

UNIT-V : VIBRATION

9+3

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

TOTAL-60

TEXT BOOKS

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

REFERENCES

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

OBJECTIVE

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

UNIT-I:CASTING**08**

Casting types, procedure to make sand mould, types of core making, moulding tolls, machine moulding, special moulding processes – CO₂ moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

UNIT-II:WELDING**08**

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

UNIT III:MACHINING**13**

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

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

UNIT- IV: FORMING AND SHAPING OF PLASTICS**07**

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

UNIT-V: METAL FORMING AND POWDER METALLURGY**09**

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

TOTAL : 45

TEXT BOOKS

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

REFERENCES

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

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

LIST OF EQUIPMENTS
(for a batch of 30 students)

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

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice and Venturi meter.
2. Calculation of the rate of flow using Rota meter.
3. Determination of friction factor of given set of pipes.
4. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
5. Conducting experiments and drawing the characteristic curves of reciprocating pump.
6. Conducting experiments and drawing the characteristic curves of Gear pump.
7. Conducting experiments and drawing the characteristic curves of Pelton wheel.
8. Conducting experiments and drawing the characteristics curves of Francis turbine.
9. Conducting experiments and drawing the characteristic curves of Kaplan turbine.
10. Flow visualization experiment on the effects of sharp corner and rounded corner and add-on devices in automobiles
11. Drag estimation on models of automobiles of different shapes

TOTAL : 45**LIST OF EQUIPMENTS**
(for the batch of 30 students)

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

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 Hrs

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.

(Common to Mechanical, Automobile & Production)

1. TESTING OF HYPOTHESIS**9 + 3**

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

2. DESIGN OF EXPERIMENTS**9 + 3**

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

3. SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**9 + 3**

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

4. INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION**9 + 3**

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

5 NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**9 + 3**

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

L = 45 T = 15 Total = 60**TEXT BOOKS**

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

BOOKS FOR REFERENCES:

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

UNIT-I GAS POWER CYCLES**10+3**

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

UNIT-II: RECIPROCATING AIR COMPRESSORS & REFRIGERATION CYCLES**10+3**

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

UNIT-III: CONDUCTION**10+2**

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

UNIT-IV: CONVECTION**10+2**

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

UNIT-V: RADIATION**8+2**

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

TOTAL-60

TEXT BOOKS

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

REFERENCES

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

ME 2253

**ENGINEERING MATERIALS AND
METALLURGY**

3 0 0 3

(Common to Mechanical & Automobile)

Objective

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

Review (Not for Exam):

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

Unit-I : CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

9(L)

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

Unit-II : HEAT TREATMENT

9(L)

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

Unit-III : MECHANICAL PROPERTIES AND TESTING

9(L)

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

Unit-IV : FERROUS AND NON FERROUS METALS**9(L)**

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

Unit-V : NON-METALLIC MATERIALS**9(L)**

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

Total Number of Periods: L= 45**T= 0 45****TEXT BOOKS**

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

REFERENCE BOOKS

1. William D Callister “Material Science and Engineering”, John Wiley and Sons 2007.
2. Raghavan.V “Materials Science and Engineering”, Prentice Hall of India Pvt., Ltd., 2007.
3. Sydney H.Avner “Introduction to Physical Metallurgy” McGraw Hill Book Company, 2007.
4. Dieter G. E., Mechanical Metallurgy, Mc Graw Hill Book Company, 1988.
5. O.P. Khanna , A text book of Materials Science and Metallurgy, Khanna Publishers, 2003.
6. Vijaya. M.S. and G. Rangarajan, Material Science, Tata McGraw-Hill , 2007

TEXT BOOKS

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

REFERENCES

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

REFERENCE BOOKS

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

OBJECTIVE:

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

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

UNIT-I: INTRODUCTION**12**

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

UNIT-II: DRIVE LINE**11**

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**11**

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**13**

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**13**

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 60**TEXT BOOKS**

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

REFERENCES

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

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- θ and P-V diagrams for IC engine with piezo-electric pick up, charge amplifier, angle encoder and PC

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

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

TOTAL : 45

AT 2256

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

0 0 4 2

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

TOTAL : 45

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. |

AT2257

**ELECTRONICS AND
MICROPROCESSORS LAB**

0 0 3 2

Objective

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

LIST OF EXPERIMENTS

ELECTRONICS

30(P)

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(P)

Block Transfer
8 bit Addition, Subtraction
Multiplication and Division
Maximum and Minimum of block of data
Sorting
Stepper Motor Interfacing

LIST OF EQUIPMENT

(for a batch of 30 students)

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

Total Number of Periods: P= 45

OBJECTIVE

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

LIST OF EXPERIMENTS

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

LIST OF EQUIPMENT

(for a batch of 30 students)

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

Total Number of Periods: P=45

