ANNA UNIVERSITY CHENNAI :: CHENNAI 600 025

UNIVERSITY DEPARTMENTS

CURRICULUM – R 2009

B.E. (PART TIME) AUTOMOBILE ENGINEERING

SEMESTER - I

Sl. No.	Code No.	Course Title	L	T	P	C
Theory						
1	PTMA 9111	Applied Mathematics	3	0	0	3
2	PTPH 9111	Applied Physics	3	0	0	3
3	PTCY 9111	Applied Chemistry	3	0	0	3
4	PTEI 9161	Electrical Engineering	3	0	0	3
5	PTGE 9111	Fundamentals of Computing	3	0	0	3
		Total	**15**	**0**	**0**	**15**

SEMESTER - II

Sl. No.	Code No.	Course Title	L	T	P	C
Theory						
1	PTMA9262	Numerical Methods	3	0	0	3
2	PTGE 9151	Engineering Mechanics	3	0	0	3
3	PTAU9201	Thermodynamics and Thermal Engineering	3	0	0	3
4	PTAU9254	Measurements and Metrology	3	0	0	3
5	PTPR 9161	Production Processes	3	0	0	3
		Total	**15**	**0**	**0**	**15**

SEMESTER - III

Sl. No.	Code No.	Course Title	L	T	P	C
Theory						
1	PTAU9203	Automotive Petrol Engines	3	0	0	3
2	PTAU9252	Automotive Chassis	3	0	0	3
3	PTAU9202	Solid Mechanics	3	0	0	3
4	PTAU9253	Automotive Electrical System	3	0	0	3
Practicle						
5	PTAU9257	Automotive Engine &Chassis Components Lab	0	0	3	2
		Total	**12**	**0**	**3**	**14**

SEMESTER - IV

Sl. No.	Code No.	Course Title	L	T	P	C
Theory						
1	PTPR9251	Theory of Machines	3	0	0	3
2	PTAU9251	Automotive Diesel Engines	3	0	0	3
3	PTAU9302	Automotive Transmission	3	0	0	3
4	PTAU9303	Two and Three Wheeler Technology	3	0	0	3
5	PTAU9307	Vehicle Design Data Characteristics	3	0	0	3
		Total	**15**	**0**	**0**	**15**

SEMESTER - V

Sl. No.	Code No.	Course Title	L	T	P	C
Theory						
1	PTAU9352	Electronic Engine Management Systems	3	0	0	3
2	PTAU9353	Vehicle Body Engineering	3	0	0	3
3	PTAU9301	Machine Components Design	3	0	0	3
4	PTAU9304	Automotive Materials and Production Techniques	3	0	0	3
Practicle						
5	PTAU9358	Engine Testing and Automotive Electronics Laboratory	0	0	3	2
		Total	**12**	**0**	**3**	**14**

SEMESTER - VI

Sl. No.	Code No.	Course Title	L	T	P	C
Theory						
1	PTAU9351	Vehicle Design	3	0	0	3
2	PTAU9401	Vehicle Dynamics	3	0	0	3
3	E1	Elective I	3	0	0	3
4	E2	Elective II	3	0	0	3
Practicle						
5	PTAU9404	Vehicle Maintenance and Re-Conditioning Laboratory	0	0	3	2
		Total	**12**	**0**	**3**	**14**

SEMESTER - VII

Sl. No.	Code No.	Course Title	L	T	P	C
Theory						
1	PTAU9402	Vehicle Maintenance	3	0	0	3
2	PTAU9305	Automotive Pollution and Control	3	0	0	3
3	E3	Elective III	3	0	0	3
4	E4	Elective IV	3	0	0	3
Practical						
5	PTAU9451	Project Work	0	0	12	6
		Total	**12**	**0**	**12**	**18**

Credits to be earned for the award of Degree: 15 + 15 + 14 + 15 + 14 + 14 +18 = **105**

LIST OF ELECTIVES FOR B. E. AUTOMOBILE ENGINEERING

Sl. No.	Code No.	Course Title	L	T	P	C
1	PTAU 9021	Automotive Aerodynamics	3	0	0	3
2	PTAU 9022	Alternate Fuels and energy systems	3	0	0	3
3	PTAU 9023	Special Types of Vehicles	3	0	0	3
4	PTAU 9024	Tractor and Farm Equipments	3	0	0	3
5	PTAU 9025	Vehicle Air-Conditioning	3	0	0	3
6	PTAU 9026	Automotive Safety	3	0	0	3
7	PTAU 9027	Rubber Technology for Automobiles	3	0	0	3
8	PTAU 9028	Fleet Management	3	0	0	3
9	PTAU 9029	Automotive Test Instrumentation	3	0	0	3
10	PTAU 9030	Advanced Production Processes for Automotive Components	3	0	0	3
11	PTAU 9031	Combustion Thermodynamics and Heat Transfer	3	0	0	3
12	PTAU 9032	Advanced Theory of IC Engines	3	0	0	3
13	PTAU 9033	Computer Integrated Manufacturing Systems	3	0	0	3
14	PTAU 9034	Theory and Design of Jigs and Fixtures	3	0	0	3
15	PTAU 9035	Hydraulic and Pneumatic systems	3	0	0	3
16	PTGE 9021	Professional Ethics in Engineering	3	0	0	3
17	PTGE 9022	Total Quality Management	3	0	0	3
18	PTGE 9023	Fundamentals of Nanoscience	3	0	0	3
19	PTAE 9354	Finite Element Method	3	0	0	3
20	PTPR 9404	Manufacturing Process Planning and Cost Estimation	3	0	0	3

(For University Departments (Part Time) under R-2009)

PTMA 9111 APPLIED MATHEMATICS

(Common to all branches of B.E / B.Tech (PT) Programmes)

L	T	P	C
3	0	0	3

UNIT I – MATRICES (9)

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

UNIT II – FUNCTIONS OF SEVERAL VARIABLES (9)

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

UNIT III – ANALYTIC FUNCTION (9)

Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping – Mapping by functions $w = a + z$, az, $1/z$, **-** Bilinear transformation.

UNIT IV – COMPLEX INTEGRATION (9)

Line Integral – Cauchy's theorem and integral formula – Taylor's and Laurent's Series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V – LAPLACE TRANSFORMS (9)

Existence conditions – Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Initial and Final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

Text Books

1. Grewal B.S., Higher Engineering Mathematics (40^{th} Edition), Khanna Publishers, Delhi (2007).
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill Co. Ltd., New Delhi (2007).

Reference Books

1. Glyn James, Advanced Modern Engineering Mathematics, Pearson Education (2007).
2. Veerarajan, T., Engineering Mathematics (For First Year), Tata McGraw-Hill Pub. Pvt Ltd., New Delhi (2006).

PTPH 9111 **APPLIED PHYSICS**

L T P C
3 0 0 3

UNIT I ULTRASONICS **9**

Introduction – Production – magnetostriction effect - magnetostriction generator-piezoelectric effect - piezoelectric generator- Detection of ultrasonic waves properties – Cavitations - Velocity measurement – acoustic grating - Industrial applications – drilling, welding, soldering and cleaning – SONAR - Non Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C –scan displays, Medical applications - Sonograms

UNIT II LASERS **9**

Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion, pumping. Einstein's A and B coefficients - derivation. Types of lasers – He-Ne, CO_2 Nd-YAG, Semiconductor lasers - homojunction and heterojunction (Qualitative)- Industrial Applications - Lasers in welding, heat treatment and cutting – Medical applications - Holography (construction and reconstruction).

UNIT III FIBER OPTICS & APPLICATIONS **9**

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – Double crucible technique of fibre drawing - Splicing, Loss in optical fibre – attenuation, dispersion, bending - Fibre optical communication system (Block diagram) - Light sources - Detectors - Fibre optic sensors – temperature and displacement - Endoscope.

UNIT IV QUANTUM PHYSICS **9**

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect - Theory and experimental verification – Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one-dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT V CRYSTAL PHYSICS **9**

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – 'd' spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – NaCl, ZnS, diamond and graphite structures – Polymorphism and allotropy - Crystal defects – point, line and surface defects- Burger vector.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Palanisamy, P.K., 'Engineering Physics' Scitech publications, Chennai, (2008).
2. Arumugam M. ' Engineering Physics', Anuradha Publications, Kumbakonam, (2007)
3. Sankar B.N and Pillai S.O. 'A text book of Engineering Physics', New Age International Publishers, New Delhi, 2007.

REFERENCES:

1. R. K. Gaur and S.C. Gupta, 'Engineering Physics' Dhanpat Rai Publications, New Delhi (2003)
2. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi, 2005.
3. Serway and Jewett, 'Physics for Scientists and Engineers with Modern Physics', 6th Edition, Thomson Brooks/Cole, Indian reprint (2007)

PTCY 9111 APPLIED CHEMISTRY

L T P C
3 0 0 3

UNIT I WATER TREATMENT AND POLLUTION CONTROL 9

Treatment of water –impurities and disadvantages of hard water-Domestic and Industrial treatment - zeolite and ion exchange processes-Portable water-Boiler feed water – conditioning of boiler feed water. Scale and sludge formation –prevention –caustic embrittlement-boiler corrosion–priming and foaming Sewage treatment–Primary, secondary and tertiary treatment–significance of DO, BOD and COD-desalination – reverse osmosis. Control of water,air and land pollution.

UNIT II FUELS 9

Classification of fuels-Proximate and ultimate analysis of coal- coke manufacture-Otto Hoffman by product method-cracking-thermal and catalytic (fixed bed and fluidized bed)-petroleum-refining-factions-composition and uses synthetic petrol-fischer drops methods- Bergius process- knocking-octane number and cetane number-Preparation, composition and uses of producer gas , water gas and natural gas. Flue gas analysis-Orsat apparatus- gross and net calorific values- calculation of minimum requirement of air(simple calculations)- Explosive range –spontaneous ignition temperature

UNIT III THERMODYNAMICS AND SURFACE CHEMISTRY 9

Second law of thermodynamics-entropy and its significance- criteria for spontaneity- free energy-Gibbs, Helmholts and Gibbs-Helmholts equation-applications and problems – Adsorption –types of adsorption- adsorption of gases on solids- adsorption isotherm-Freundlich and Langmuir isotherms-adsorption of solutes from solutions- applications

UNIT IV ELECTROCHEMISTRY - CORROSION AND CATALYSIS 9

Reversible and irreversible cells-electrode potentials-types of electrodes-cell reactions-Nernst equations- electrochemical and galvanic series-fuel cells and solar cells-corrosion-chemical and electrochemical-factors affecting corrosion-sacrifical anode-impressed current cathodic protection-surface treatment and protective coating-Catalysis –classification-characteristics of catalysis – auto catalysis- enzyme catalysis

UNIT V POLYMERS-COMPOSITES AND NANOCHEMISTY 9

Polymers-definition-classification-thermoplastics and thermosetting plastics differences Preparation, properties and uses of polystyrene, bakelite, PET, polyurethane, Teflon, ureafromaldehyde, polycarbonates-Elastomers-Preparation, properties of Buna-S, nitrile, neoperene and butyl rubber, silicon rubber. Composites-FRP. Nanochemistry-introduction to nanochemistry- preparation and properties of nonmaterial-nano rods, nano wires-nanotubes-carbon nanotubes and their applications.

TOTAL PERIODS 45

TEXT BOOKS:

1. Dhara S S A text book of Engineering Chemistry, S.Chand & Co Ltd, New Delhi,2002
2. Jain. P.C and Monica Jain, Engineering Chemistry,Dhanpet Rai & Sons, New Delhi 2001

REFERENCE BOOKS

1. Puri B R.,Sharma L R and Madhan S. Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand & Co. Jalandar-2000.
2. G.B. Sergeev, Nanochemistry.Elsevier Science, New York,2006
3. V.R.Gowarikar, N.V.Viswanathan and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras (2006).

PTEI 9161 **ELECTRICAL ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVE:

To impart the knowledge on basic concepts of electrical circuits, electromagnetism and electrical machines.

UNIT – I BASIC CONCEPTS AND DC CIRCUITS

Ohm's law - Electrical resistance - Series /Parallel resistive circuits - Star/Delta transformations - Kirchoff's law - Node and Mesh analysis - Thevenin's and Norton's theorem.

UNIT – II ELECTROMAGNETISM

Magnetic flux - MMF - Flux density - B H curves - Simple and Composite magnetic circuits - Statically induced EMF - Self and Mutual Inductances - Coupling coefficient - Stored energy - Force on a conductor - Magnetic pull - Force between parallel conductors.

UNIT – III A.C.CIRCUITS

RMS and average value of periodic waves - Form factor - Phase and Phase difference - Simple RC.RL and RLC circuits - series and parallel resonance - power and power factor - introduction to three phase systems – power measurement in 3 phase system.

UNIT – IV D.C. MACHINES

Construction details of DC machines - principle of operation of DC generator - EMF equation - characteristics of DC generators - principle of DC motor - Back EMF - Voltage and torque equation - Characteristics of shunt, series and compound motors.

UNIT – V A.C. MACHINES

Principle of ideal transformer - construction and type - EMF equation - Tests on transformer - Equivalent circuit - Voltage regulation - Construction of synchronous machines - Principle of alternator - EMF equation - Torque equation - V-curves - Induction motor - Construction and basic principle of operation slip - Starting and Running torques.

TOTAL : 45 PERIODS

REFERENCES:

1. Theraja, B.L., "A Text Books of Electrical Technology ", S.S.Chand and Co., New Delhi, 1998.
2. Edminister J.A., "Theory and Problems on Electric circuits ", McGraw Hill International Edition, 1994.
3. Kosow, I.L., "Electrical Machinery and Transformers ", 4th Edition, Prentice Hall of India, 1991.
4. Nagrath I.J. and Kothari D.P., "Theory and Problems of Basic Electrical Engineering", Prentice Hall of India, 1998.

PTGE 9111 **FUNDAMENTALS OF COMPUTING** **L T P C**
3 0 0 3

UNIT – I

9

Computer systems – Exploring computers – Inside the system – processing data – CPUs – Types of storage devices - Operating systems basics – networking basics.

UNIT – II

9

The internet and the WWW – Internet services – connecting to the internet - Working with applications software – productivity software – graphics and multimedia – Data base Management systems – Creating computer program.

UNIT – III

9

C programming fundamentals – compilation process – variables – Data types – Expressions – looping – decisions.

UNIT – IV

9

Arrays - Working with functions – structures – character strings – pre processor.

UNIT –V

9

Pointers – Dynamic memory allocation – linked list - Applications

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Peter Norton, “Introduction to Computers”, Sixth Edition, Tata McGraw Hill, 2007.
2. Stephen G. Kochan, “Programming in C”, Third Edition, Pearson Education, 2007.

REFERENCES:

1. B.W.Kernighan and D.M.Ritchie, “The C Programming language”, Second Edition, Pearson Education, 2006
2. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
3. Kenneth A. Reek, “Pointers on C”, Pearson Education, 2007.
4. R.G.Dromey, “How to solve it by Computer”, Pearson Education, 2007.

PTMA 9262 **NUMERICAL METHODS** **L T P C**
3 0 0 3

AIM:
This course gives a complete procedure for solving numerically different kinds of problems occurring in engineering and technology.

OBJECTIVES:
The students would be acquainted with the basic concepts of numerical methods and their applications.

UNIT – I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

Solution of algebraic and transcendental equations – Fixed point iteration method – Newton-Raphson method – Solution of linear system of equations – Gauss Elimination method – Pivoting – Gauss-Jordan methods – Matrix Inversion by Gauss-Jordan method – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Eigenvalues of a matrix by Power method and by Jacobi's method.

UNIT – II INTERPOLATION AND APPROXIMATION 9

Interpolation with unequal intervals – Lagrange interpolation – Newton's divided difference interpolation – Cubic Splines – Interpolation with equal intervals – Newton's forward and backward difference formulae.

UNIT – III NUMERICAL DIFFERENTATION AND INTEGRATION 9

Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT – IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step-methods – Taylor's series method – Euler's method – Fourth order Runge-Kutta method for solving first and second order equations – Multi-step methods – Milne's and Adams-Bashforth predictor-corrector methods for solving first order equations.

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

Finite difference methods for solving two-point linear boundary value problems. Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank Nicholson) methods - One dimensional wave equation by explicit method.

Total : 45 PERIODS

TEXT BOOKS:

1. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, (2004).
2. Sankara Rao, K. "Numerical methods for Scientists and Engineers', 3rd Edition Prentice Hall of India Private Ltd., New Delhi, (2007).

REFERENCES:

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, (2007).
2. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, (2006).
3. Brian Bradie, "A friendly introduction to Numerical analysis", Pearson Education Asia, New Delhi, (2007).

PTGE 9151 **ENGINEERING MECHANICS** **L T P C**
3 0 0 3

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

UNIT – I BASICS AND STATICS 9

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

UNIT – II EQUILIBRIUM OF RIGID BODIES 9

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

UNIT – III PROPERTIES OF SURFACES AND SOLIDS 9

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

UNIT – IV DYNAMICS OF PARTICLES 9

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

UNIT – V CONTACT FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 9

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling friction – Belt friction Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion – Impact of elastic bodies

Total = 45

TEXT BOOK

1. Beer,F.P and Johnson Jr. E.R, “Vector Mechanics for Engineers”, Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, 2007.

REFERENCES

1. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition – PHI / Pearson Education Asia Pvt. Ltd., 2003
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Ashok Gupta, Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM), Pearson Education Asia Pvt., Ltd., 2002
4. J.L. Meriam & L.G. Karige, Engineering Mechanics Vol. I & Vol. II, V edition, John Wiley & Sons, 2006.
5. P. Boresi & J. Schmidt, Engineering Mechanics Statics & Dynamics, Micro Print Pvt. Ltec., Chennai, 2004.

PT AU 9201 THERMODYNAMICS AND THERMAL ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

To introduce fundamental concepts in thermodynamics, heat transfer, propulsion and refrigeration and air conditioning.

UNIT – I BASIC THERMODYNAMICS 9

Systems, Zeroth low, First law. Properties of gases and vapours. Steady flow energy equation. Heat and work transfer in flow and non-flow processes. Second law, Kelvin-Planck statement - Clausius statement - Concept of Entropy, Clausius inequality, Entropy change in non-flow processes.

UNIT – II AIR CYCLE AND COMPRESSORS 9

Otto, Diesel, Dual and Brayton cycles. Air standard efficiency. Mean effective pressure, Reciprocating compressors – Intercooling – Minimum work requirement.

UNIT – III STEAM ENGINE AND BOILERS 9

Properties of steam – Rankine cycle – Steam Nozzles – Steam Engines – Simple jet propulsion system.

UNIT – IV REFRIGERATION AND AIR-CONDITIONING 9

Principles of Psychrometry and refrigeration - Vapour compression - Vapour absorption types - Co-efficient of performance, Properties of refrigerants – Basic Principle and types Air conditioning.

UNIT – V HEAT TRANSFER 9

Conduction in parallel, radial and composite wall – Basics of Convective heat transfer - Fundamentals of Radiative heat transfer – Flow through heat exchangers.

TOTAL = 45 PERIODS

(Use of standard thermodynamic tables, Mollier diagram and Refrigerant property tables 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 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.

PTAU 9254 MEASUREMENTS AND METROLOGY L T P C
3 0 0 3

OBJECTIVE:

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

UNIT – I LINEAR MEASUREMENT 9

Units and standards, errors in measurement, linearity, repeatability, precision and accuracy, calibration. Linear measuring instruments, taper, wire and thickness gauge, vernier instruments, micrometer, internal measurements slip gauges and its accessories, dial gauges, comparators.

UNIT – II FORM AND SURFACE MEASUREMENT 9

Interferometry surface texture measurements, flatness testing, collimators, angular measurements, metrology of screw threads, measurement and testing of gears, measuring machines.

UNIT – III PRESSURE MEASUREMENT 9

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

UNIT – IV FLOW AND TEMPERATURE MEASUREMENT 9

Obstruction type flow meter, Positive displacement flow meters – turbine flow meter, flouted tube flowmeter, anemometer, ultrasonic flow meter, magnetic flow meters. Alcock viscous air flow meter. Temperature scales – mechanical temperature sensors, liquid in glass, vapour pressure, bimetal temperature gauges. RTD, Thermistors, thermocouples, Pyrometers.

UNIT – V FORCE AND TORQUE MEASUREMENT 9

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

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Jain R.K., Engineering metrology, Khanna publishers, New Delhi, 2005
2. Rangan C.S., Sarma G.E and Mani V.S Instrumentation devices and systems. TMH Publishing Co. New Delhi, 2001
3. Beckwith T.G & Buck N.L Mechanical measurements, Oxford and IBH publishing house New Delhi, 2004

REFRENCES:

1. Patranabis D, Principles of industrial instrumentation, TMH Publishing Co. New Delhi, 2000
2. Jain R.K., Mechanical & Industrial measurements , Khanna publishers, New Delhi, 2005
3. Doeblin,"Measurement System Application &Design" McGraw Hill ,New Delhi, 2004
4. Gaylor F.W and Shotbolt C.R Metrology for engineers, ELBS, 2006

PTPR 9161 **PRODUCTION PROCESSES** **L T P C**
3 0 0 3

OBJECTIVE :
To familiarise the students with various production processes such as casting, forming, machining, welding and unconventional production processes.

UNIT – I INTRODUCTION AND CASTING 8

Classification and comparison of manufacturing processes – criteria for selection of a process. Casting types – Sand casting –Green sand, Dry sand, Core sands – procedure to make sand moulds and cores – principle of die casting – gravity and pressure die casting – squeeze casting - centrifugal casting, investment casting – shell moulding – continuous casting

UNIT – II METAL FORMING AND POWDER METALLURGY 10

Basic concepts and classification of forming processes – Principles – application of the following processes – forging, rolling, extrusion, wire drawing, spinning, sheet metal forming – powder metallurgy – steps involved, applications. High energy Rate forming – Explosive, Electro Hydraulic, Magnetic Pulse forming.

UNIT – III CONVENTIONAL MACHINING 10

General principles (with schematic diagrams only) of working, types and commonly performed operations in the following machines – lathe, shaper, planer, milling, drilling and grinding machines – super finishing basics of CNC machines.

UNIT – IV WELDING 7

Classification of welding processes – principles and equipment used in the following processes – Arc welding – shielded metal arc welding, gas metal arc welding, ags tungsten arc welding, submerged arc welding, electro slag welding,flux cored arc welding - Resistance welding – Diffusion bonding – Flash butt welding -Thermit welding – soldering – brazing.

UNIT – V UNCONVENTIONAL MACHINING PROCESSES 10

Need for unconventional machining processes – principles and application of the following processes – abrasive jet machining, ultrasonic machining, Electro discharge machinery, electrochemical machining, chemical machining, LASER beam machining, Electron beam machining, plasma arc machining- Hybrid machining processes.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Serope Kalpakjain, Steven R Schmid, “Manufacturing Process for Engineering Materials”, Pearson Education, Fourth Edition, 2003
2. Gowri, Hariharan, Suresh Babu, Manufacturing Technology-I, Pearson Education, 2007

REFERENCES:

1. Hajra Choudhury, Elements of Workshop Technology, Vol.I and Vol.II, Asia Publishing House, 1996.
2. R.K.Jain and S.C. Gupta, Production Technology, Khanna Publishers,’97.
3. H.M.T. Production Technology – Hand Book, Tata McGraw Hill, 1990.
4. Rao .P.N. “Manufacturing Technology” Tata McGraw Hill, 2002.

PTAU 9203 AUTOMOTIVE PETROL ENGINES L T P C
3 0 0 3

AIM:
To impart the knowledge on basic concepts on Automotive SI Engines and its various sub components along with its functions.

OBJECTIVE:
The main objective of this course is to impart knowledge in automotive petrol engine. The detailed concept, construction and principle of operation of petrol engine (both 4S and 2S) and various engine components, combustion, cooling and lubrication systems will be taught to the students. At the end of the course the students will have command over automotive petrol engines.

UNIT – I ENGINE CONSTRUCTION AND OPERATION 10

4 stroke engine - Constructional details, working principle. Otto cycle, Actual indicator diagram, Fuel air cycle. Cylinder layout and configurations. Firing order and its significance. Engine balancing. Materials of engine components.

UNIT – II FUEL SYSTEM 10

Carburettor working principle. Requirements of an automotive carburetor – starting, idling, acceleration and normal circuits of a carburetor – Compensation – Maximum power devices – Constant choke and constant vacuum carburetor, multi barrel and multiple venturi systems – Fuel feed system – Mechanical and electrical pumps – Petrol injection.

UNIT – III COOLING AND LUBRICATION SYSTEM 8

Need for cooling. Types of cooling system – air cooling and Liquid cooled systems. Forced circulation system, pressure cooling system – Need for Lubrication system. Mist lubrication system, wet sump lubrication – Properties of lubricants, properties of coolant.

UNIT – IV COMBUSTION AND COMBUSTION CHAMBERS 9

Combustion in SI engine – Stages of combustion – Flame propagation – Rate of pressure rise – Abnormal combustion – pre ignition and knock – effect of engine variables on knock – Combustion chambers – Different types – Factors controlling combustion chamber design.

UNIT – V TWO STROKE ENGINES 8

Two stroke engine – types, terminologies, definitions, construction and operation. Comparison of four stroke and two stroke engine operation. Theoretical scavenging methods. Scavenging pumps – Types of scavenging.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Ramalingam. K. K., Internal Combustion Engines, Scitech publications, Chennai, 2003
2. Ganesan.V., Internal Combustion Engines, Tata McGraw Hill Publishing Co., New York, 1994.

REFERENCES:

1. Heldt.P.M. High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1975.
2. Obert E.F., Internal Combustion Engines Analysis and Practice, International Text Books: Co., Scranton, Pennsylvania, 1988.
3. William.H.Crouse, Automotive Engines, McGraw Hill Publishers, 1985.
4. Ellinger, H.E., Automotive Engines, Prentice Hall Publishers, 1992.

PT AU 9252 AUTOMOTIVE CHASSIS L T P C
3 0 0 3

OBJECTIVE:

- Study of the Constructional details and Theory of important drive line, Structural,
- Steering, Braking and Suspension Systems of Automobiles.
- Problem–Solving in Steering Mechanism, Propeller Shaft, Braking and Suspension Systems are to be done.

UNIT – I INTRODUCTION, FRAME, STEERING SYSTEM 9

Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames, Types of Front Axles and Stub Axles, Front Wheel Geometry, namely, Castor, Camber, King Pin Inclination and Toe–in, Condition for True Rolling Motion of Wheels during Steering, Ackerman's and Davis 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 PROPELLER SHAFT AND FINAL DRIVE 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 AND TYRES 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, Hydraulic, Mechanical, Pneumatic and Power–Assisted Braking System, Servo Brakes, Retarders, Anti–Lock Braking System.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Kripal Singh, Automobile Engineering, Standard Publisher, New Delhi , 2006
2. R.K. Rajput, A Text–Book of Automobile Engineering, Laxmi Publications Private Limited, 2007
3. N.K. Giri, Automotive Mechanics, Kanna Publishers, 2007

REFERENCES:

1. Heldt P.M., Automotive Chassis, Chilton Co., New York, 1990
2. Newton Steeds and Garret, Motor Vehicles, 13th Edition, Butterworth, London, 2005.
3. Heinz Hezler, Modern Vehicle Technology, Butterworth, London, 2005.

PTAU 9202 **SOLID MECHANICS** **L T P C**
3 0 0 3

OBJECTIVE:

- To gain knowledge of simple stresses, strains and deformation in components due to external loads.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- Effect of component dimensions and shape on stresses and deformations are to be understood.
- The study would provide knowledge for use in the design courses

To provide knowledge on analysis of various structural elements for different loading conditions.

UNIT – I AXIAL LOADING 9

Stresses and strains – Hooke's law – stress and strain diagrams - elastic constants – statically determinate and indeterminate problems in tension & compression – thermal stresses – impact loading.

UNIT – II STRESSES IN BEAMS 9

Shear force & bending moment diagrams – bending stresses – shear stress variation in beams of symmetric sections – beams of uniform strength.

UNIT – III DEFLECTION OF BEAMS 9

Double integration method – Macaulay's method – moment area method – conjugate beam method – principle of superposition – Strain Energy in axial, bending, torsion and shear loadings. Castigliano's theorems and their applications.

UNIT – IV TORSION – SPRINGS – COLUMNS 9

Torsion of solid and hollow circular shafts – shear stress variation – power transmission in shafts – open and closed-coiled helical springs – stresses in helical springs – classification of columns – Euler buckling – columns with different end conditions.

UNIT – V BIAXIAL STRESSES 9

Stresses in thin-walled pressure vessels – combined bending, torsion and axial loading of circular shafts – Mohr's circle and its construction – determination of principal stresses.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Gere & Timoshenko, 'Mechanics of Materials', McGraw Hill, 1993
2. William Nash, Strength of Materials, Tata McGraw Hill, 2004

REFERENCES:

1. Dym,C.L., and Shames,I.H., 'Solid Mechanics', McGraw Hill, Kogakusha, Tokyo, 1973.
2. Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, Third Edition.
3. R.K.Rajput, 'Strength of Materials', S. Chand and Co., 1999.
4. Timoshenko,S. and Young,D.H., Elements of Strength of Materials, T.Van Nostrand Co. Inc., Princeton, N.J., 1977.

PTAU 9253 AUTOMOTIVE ELECTRICAL SYSTEMS L T P C
3 0 0 3

AIM:

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

OBJECTIVE :

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

UNIT – I BATTERIES 08

Principle and construction of lead-acid battery. Characteristics of battery, rating, capacity and efficiency of batteries. Various tests on battery condition, charging methods. Details of modern storage batteries.

UNIT – II STARTING SYSTEM 09

Condition of starting Behavior of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units. Care & maintenance of starter motor, Starter switches.

UNIT – III CHARGING SYSTEM 09

Function, Components of DC and AC Charging System for Automobile, construction, operating principle, characteristics, charging circuit controls – cut out, relays, voltage and current regulators, troubleshooting

UNIT – IV IGNITION SYSTEM 10

Types, construction & working of battery coil and magneto ignition systems. Relative merits, centrifugal and vacuum advance mechanisms. Types and construction of spark plugs, Electronic Ignition system. Digital ignition system.

UNIT – V LIGHTING SYSTEM & ACCESSORIES 09

Insulated & earth return systems. Positive & negative earth systems. Details of head light & side light. Head light dazzling & preventive methods. Electrical fuel-pump, Speedometer, Fuel, oil & temperature gauges, Horn, Wiper system, Trafficator, wiring system.

TOTAL : 45 PERIODS

TEXT BOOK:

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

REFERENCES:

1. Young,A.P. & Griffiths,L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990.
2. Vinal,G.W., Storage Batteries, John Wiley & Sons Inc., New York, 1985.
3. Crouse,W.H., Automobile Electrical Equipment, McGraw Hill Book Co. Inc., New York, 1980.
4. Spreadbury,F.G., Electrical Ignition Equipment, Constable & Co. Ltd., London, 1962.
5. Kholi,P.L., Automotive Electrical Equipment, Tata McGraw-Hill Co. Ltd., New Delhi, 1975.
6. Automotive Hand Book, fifth edition, Robert Bosch, Bently Publishers, 2003.

PTAU9257 AUTOMOTIVE ENGINE AND CHASSIS COMPONENTS LABORATORY **L T P C 0 0 3 2**

AIM:

To familiarize and train the students on the constructional arrangements of different engine system and chassis systems of different vehicles..

OBJECTIVE:

The main objective of this course is to impart knowledge in the assembling and dismantling and study of different types of an engine and its various systems like steering system, transmission system, electrical system, ignition system, injection system, Braking system. At the end of the course the student will be well versed in the assembling and dismantling of any vehicles.

Study of the following engines and its components:

- Tata engine
- Leyland engine
- Ambassador engine
- Fiat engine
- Maruthi engines
- Ford engines
- MPFI Engine

Study and measurement of the following chassis

- Tata
- Leyland
- Ambassador
- Premier Padmini
- Maruthi car (Front engine, front wheel drive & constant velocity joint)

Study, dismantling & assembling

- Front axle – Rzeppa joint assembly
- Rear axle
- Clutch 2 types – Coil spring& Diaphragm spring clutches
- Gear box – Sliding mesh, Constant mesh & Synchromesh Gear Box
- Transfer case
- Steering system
- Braking system
- Differential mechanism
- Power steering mechanism

TOTAL : 45 PERIODS

PT PR 9251 **THEORY OF MACHINES** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the basic concepts of mechanisms and machinery
- To expose the students the different mechanisms, their method of working, Forces involved and consequent vibration during working

UNIT – I MECHANISMS 9

Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint & motion – Degrees of freedom slider crank – Single and double – Crank rocker mechanisms – Inversions – applications, Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT – II FRICTION 9

Types of friction – friction in screw and nut – pivot and collar – thrust bearings – collar bearing – plate and disc clutches – belt (flat & vee) and rope drives – creep in belts – Jockey pulley – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – Effect of centrifugal and initial tension – condition for maximum power transmission.

UNIT – III GEARS AND CAMS 9

Gear profile and geometry – nomenclature of spur & helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple and compound gear trains – determination of speed and torque in epicyclic gear trains – cams different types of followers – cam design for different follower motions.

UNIT – IV BALANCING 9

Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – balancing single and multi cylinder Engines – Governors and Gyroscopic effects.

UNIT – V VIBRATION 9

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multirotor systems – geared shafts – critical speed of shafts.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Bansal Dr.R.K. " Theory of Machines" Laxmi Publications (P) Ltd., New Delhi 2001
2. Rattan S.S."Theory of machines" Tata McGraw Hill publishing Co., New Delhi, 2002.

REFERENCES:

1. Rao J.S.and Dukkipati R.V. "Mechanism and Machine Theory" Second Edition, Wiley Eastern Limited, 1992.
2. Malhotra D.R. and Gupta H.C "The Theory of machines" Satya Prakasam, Tech. India Publications, 1989
3. Gosh A and Mallick A.K. "Theory of Machines and Mechanisms" affiliated east west press, 1989
4. Shingley J.E. and Vicker J.J. Theory of Machines and Mechanisms" McGraw Hill, 1986.
5. Burton Paul "Kinematics and Dynamics of Machinery", Prentice Hall, 1979.

PT AU 9251 AUTOMOTIVE DIESEL ENGINES L T P C
3 0 0 3

OBJECTIVE:

The objective of this course is to have knowledge in automotive diesel engines. The construction and principle of operation of various types of engines, fuel injection system Theory of combustion and types of combustion chamber air motion air motion will be taught to the students. The design advances in IC engines Electronic fuel injection system will all so be introduce to the students. At the end of the course the students will have command over automotive MPFI concepts and application.

UNIT – I BASIC THEORY 9

Diesel engine construction and operation. Two stroke and four stroke diesel engines. Diesel cycle – Fuel-air and actual cycle analysis. Diesel fuel. Ignition quality. Cetane number. Laboratory tests for diesel fuel. Standards and specifications.

UNIT – II FUEL INJECTION SYSTEM 9

Requirements – solid injection. Function of components –common rail direct injection - Jerk and distributor type pumps. Pressure waves, Injection lag. Unit injector. Mechanical and pneumatic governors. Fuel injector, Types of injection nozzle, Nozzle tests. Spray characteristics. Injection timing. Pump calibration. Pilot injection.

UNIT – III AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS 10

Importance of air motion – Swirl, squish and turbulence, Swirl ratio. Fuel air mixing. Stages of combustion. Delay period – factors affecting delay period. Knock in CI engines. Comparison of knock in CI & SI engines. Direct and indirect injection combustion chambers. Air cell chamber. Combustion chamber design – objectives – Different types of combustion chamber. M.Combustion chamber. Combustion chambers for Homogeneous charge compression ignition systems – Dual and alternate fueled engine systems.

UNIT – IV SUPERCHARGING AND TURBOCHARGING 8

Necessity and limitation – Charge cooling. Types of supercharging and turbocharging – Relative merits. Matching of turbocharger.

UNIT – V ENGINE PERFORMANCE AND EVALUATION 9

Automotive and stationary diesel engine testing and related standards – Engine power and efficiencies - performance characteristics. Variables affecting engine performance – Methods to improve engine performance – Heat balance – Performance maps.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. K. K. Ramalingm, internal Combustion Engines, Scitech publications, Chennai, 2003.
2. Ganesan,V., Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi, 1994.

REFERENCES:

1. Heldt,P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1985.
2. Obert,E.F., Internal Combustion Engine analysis and Practice, International Text Book Co., Scranton, Pennsylvania, 1988.
3. Maleev,V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 1974.
4. Dicksee,C.B., Diesel Engines, Blackie & Son Ltd., London, 1964.

PT AU 9302 AUTOMOTIVE TRANSMISSION L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to impart knowledge in automotive transmission. The detailed concept, construction and principle of operation of various types of mechanical transmission components, hydrodynamic devices, hydrostatic devisees and automatic transmission system will be taught to the students. The design of clutch and gearbox will all so be introduce to the students. At the end of the course the students will have command over automotive transmission concepts and application.

UNIT – I CLUTCH AND GEAR BOX 9

Problems on performance of automobile - such as resistance to motion, tractive effort, engine speed, engine power and acceleration. Requirement of transmission system. Different types of clutches, principle, Construction and torque capacity. Determination of gear ratios for vehicles. Different types of gearboxes such as Sliding mesh gearbox, Constant mesh gearbox and Synchromesh gearbox.

UNIT – II HYDRODYNAMIC DRIVE 9

Fluid coupling - Principle of operation, Constructional details, Torque capacity, Performance characteristics and Reduction of drag torque. Hydrodynamic Torque converter - Principle of operation, Constructional details and Performance characteristics. Multistage torque converters. Polyphase torque converters. Converter coupling

UNIT – III PLANETARY GEAR BOXES 9

Construction and operation of Ford – T-model gearbox, Wilson Gear box and Cotal electromagnetic transmission.

UNIT – IV AUTOMATIC TRANSMISSION APPLICATIONS 9

Need for automatic transmission, Principle of operation. Hydraulic control system for automatic transmission. Chevrolet “Turboglide” Transmission, Continuously Variable Transmission (CVT) – Types – Operations.

UNIT – V HYDROSTATIC AND ELECTRIC DRIVE 9

Hydrostatic drive - Various types of hydrostatic systems, Principles of Hydrostatic drive system. Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive, Construction and Working of typical Janny hydrostatic drive. Electric drive - Principle of operation of Early and Modified Ward Leonard Control system, Advantages & limitations.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Newton and Steeds, Motor vehicles, Illiffe Publishers, 2000.
2. Judge, A.W., Modern Transmission systems, Chapman and Hall Ltd., 1990.

REFERENCES:

1. Heldt, P.M., Torque converters, Chilton Book Co., 1992.
2. SAE Transactions 900550 & 930910.
3. Hydrostatic transmissions for vehicle applications, I Mech E Conference, 1981-88.
4. Crouse, W.H., Anglin, D.L., Automotive Transmission and Power Trains construction, McGraw Hill, 1992.

PT AU 9303 TWO AND THREE WHEELER TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

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

UNIT – I THE POWER UNIT 9

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

UNIT – II CHASSIS AND SUB-SYSTEMS 8

Main frame, its types. Chassis and shaft drive. Single, multiple plates and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar.

UNIT – III BRAKES AND WHEELS 8

Drum brakes, Disc brakes, Front and rear brake links lay-outs. Spoked wheel, cast wheel. Disc wheel. Disc types. Tyres and tubes.

UNIT – IV TWO WHEELERS 10

Case study of motor cycles, scooters and mopeds. Servicing and maintenance.

UNIT – V THREE WHEELERS 10

Case study of Auto rickshaws, Pick up van, Delivery van and Trailer. Servicing and maintenance.

TOTAL : 45 PERIODS

TEXTBOOK:

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

REFERENCES:

1. The Cycle Motor Manual, Temple Press Ltd., London, 1990.
2. Encyclopedia of Motor cycling, 20 volumes, Marshall Cavensih, New York and London, 1989.
3. Bryaut,R.V., Vespa Maintenance and Repair series.
4. Raymond Broad, Lambretta – A practical guide to maintenance and repair, 1987.

PTAU 9307 VEHICLE DESIGN DATA CHARACTERISTICS 0 0 3

AIM:

To impart knowledge about the engine behavior at different torque and speed conditions. Exposure will be given about air resistance, rolling resistance, gradient resistance, driving force and brake horse power;

OBJECTIVE:

Students have to collect important technical specifications of an automobile from Automobile Journals and keeping this, as a guide, they have to calculate and tabulate various vehicle performance parameters and design parameters and to draw curves using these data. After completion of this syllabus students will have idea about differential performance curves and different operating conditions of engines.

UNIT – I PERFORMANCE CURVE 15

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

UNIT – II EXPECTANCY CURVES 30

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

TOTAL : 45 PERIODS

TEXTBOOK:

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

REFERENCES:

1. Lichty, IC Engines, Kogakusha Co. Ltd., Tokyo, 1991.

2. Automotive Engineering Journals Auto Car, Automotive Industries, Automobile Engineer.

3. Giri,K., Automobile Mechanics, Khanna Publishers, New Delhi, 1986.

PTAU 9352 ELECTRONIC ENGINE MANAGEMENT SYSTEM L T P C
3 0 0 3

OBJECTIVE:

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

UNIT – I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 9

Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines.

UNIT – II SENSORS AND ACTUATORS 9

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

UNIT – III SI ENGINE MANAGEMENT 9

Three way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch Monojetronic, L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Advantages of electronic ignition systems. Types of solid state ignition systems and their principle of operation, Contactless electronic ignition system, Electronic spark timing control.

UNIT – IV CI ENGINE MANAGEMENT 9

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

UNIT – V DIGITAL ENGINE CONTROL SYSTEM 9

Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control – Integrated engine control system, Exhaust emission control engineering, Electromagnetic compatibility – EMI Suppression techniques – Electronic dash board instruments – Onboard diagnosis system.

TOTAL : 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

PTAU 9353 VEHICLE BODY ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

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

UNIT – I CAR BODY DETAILS 10

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

UNIT – II VEHICLE AERODYNAMICS 9

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

UNIT – III BUS BODY DETAILS 9

Types – based on capacity, based on distance traveled and based on construction such as Mini bus, Single Decker, Double Decker, Two level, Split-level and Articulated bus. Bus body lay out, Types of metal sections used, Regulations. Constructional details of Conventional and Integral type construction.

UNIT – IV COMMERCIAL VEHICLE DETAILS 8

Different types of commercial vehicle bodies. Light commercial vehicle body types. Construction details of flat platform body, Tipper body & Tanker body – Dimensions of driver's seat in relation to controls – Drivers cab design.

UNIT – V BODY MATERIALS, TRIM AND MECHANISMS 9

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

TOTAL : 45 PERIODS

TEXTBOOK:

1. Powloski, J., Vehicle Body Engineering, Business Books Ltd., 1998.

REFERENCES:

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

PTAU9301 MACHINE COMPONENTS DESIGN L T P C
3 0 0 3

AIM:

This course gives a complete procedure for designing different kinds of problems occurring in design engineering field especially in automobile engineering.

OBJECTIVE:

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

UNIT – I INTRODUCTION 12

Classification of design – Engineering materials and their physical properties as applied to design – Selection of materials – Factors of safety in design – Endurance limit of materials – Determination of endurance limit for ductile materials – Notch sensitivity – Principle of design optimization – Future trends – CAD Euler's formula – – Rankine's formula – Tetmajer's formula – Johnson formula – Design of push rods and eccentricity loaded columns – Reduction of stress concentration.

UNIT – II DESIGN OF SHAFTS AND SPRINGS 9

Introduction – Material and design stresses – Design of axles – Design of shafts on the basis of strength – Design of shaft on the basis of rigidity – Design of hollow shafts – Design of close coiled helical spring subjected to axial loading – Torsion of helical springs.

UNIT – III GEAR DESIGN 8

Design considerations – strength of gear teeth – Lewis equation – Terminology of gears- Dynamic tooth load – Design of spur gears – helical gears – herringbone gears – bevel gears and worm gears.

UNIT – IV FLYWHEELS 7

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

UNIT – I DESIGN OF BEARINGS 9

Design of journal bearings - Ball and Roller bearings – Types of Roller bearings – Bearing life – Static load capacity – Dynamic load capacity – Bearing material – Boundary lubrication – Oil flow and temperature rise.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Jain,R.K., Machine Design, Khanna Publishers, 1992.
2. Sundararaja Murthy,T.V., Machine Design, Khanna Publishers, New Delhi, 1991.
3. Bhandari,V.B., Design of Machine elements, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1990.

REFERENCES:

1. Hall Allen,S. & Others, Machine Design, Schaum Publisher Co., 1982.
2. Sigley, Machine Design, McGraw Hill, 1981.
3. Design Data Book, PSG College of Technology, Coimbatore, 1992.

PTAU 9304 AUTOMOTIVE MATERIALS AND PRODUCTION TECHNIQUES **L T P C 3 0 0 3**

UNIT – I ELASTIC AND PLASTIC BEHAVIOUR OF MATERIALS 9

Elasticity-forms - Stress and strain relationship in engineering materials - Deformation mechanism -Strengthening material - Strain hardening, alloying, polyphase mixture, martensitic precipitation, dispersion, fibre and texture strengthening - iron carbon diagram.

UNIT – II HEAT TREATMENT AND SURFACE TREATMENT 10

Heat treatment of steel - Annealing - Types, normalising, Types, hardening and tempering with specific relevance to automotive components, surface hardening techniques, Induction, flame and chemical hardening, coating of wear and corrosion resistance, Electroplating. Phosphating, Anodizing, hot dipping, thermal spraying, hard facing and thin film coatings.

UNIT – III SELECTION OF MATERIALS 9

Criteria of selecting materials for automotive components viz cylinder block, Cylinder head, piston, piston ring, Gudgeon pin, connecting rod, crank shaft, crank case, cam, cam shaft, engine valve, gear wheel, clutch plate, axle, bearings, chassis, spring, body panel - radiator, brake lining etc. Application of non-metallic materials such as composite, ceramic and polymers in automobile.

UNIT – IV CASTING FOR AUTOMOTIVE ENGINE COMPONENTS 8

Sand casting of cylinder block and liners – Centrifugal casting of flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston, pressure die casting of carburetor and other small auto parts.

UNIT – V MACHINING OF AUTOMOTIVE ENGINE COMPONENTS 9

Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins - piston rings- valves - front and rear axle housings - fly wheel - Honing of cylinder bores - Copy turning and profile grinding machines – Materials and properties.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Khanna.O.P., " Material Science and Metallurgy ", Dhanapal Rai & Sons, 1992.
2. Heldt,P.M., High Speed Combustion Engines, Oxford Publishing Co., New York, 1990.

REFERENCES:

1. Kapoor, " Material Science and Processes ", New India Publishing House, 1987.
2. Dieter.G.E., Mechanical Metallurgy, McGraw Hill, New York, 1972.
3. Avner.S.H., Introduction to physical metallurgy, MaGraw Hill, New York., 1982.
4. Raghavan.V., Physical Metallurgy, Principle and Practice, Prentice Hall, 1995.
5. Avner S.H". Introduction to Physical Metallurgy" McGraw-Hill, New York, 1982.
6. Haslehurst,S.E., Manufacturing Technology, ELBS, London, 1990.
7. Upton, Pressure Die Casting, Pergamon Press, 1985.

PTAU9358 ENGINE TESTING AND AUTOMOTIVE ELECTRONICS LAB L T P C
0 0 3 2

OBJECTIVE:

The main objective of this course is to impart practical knowledge in automotive engine testing. The detailed testing of performance characteristics of various IC engine will be taught to the students. At the end of the course the students will have command over testing of performance and emission characteristics of IC engines.

To provide hands on training on basic electronic components and to provide knowledge on interfacing of different sensors and actuators used in the automobile systems.

1. Study and use of IC engine testing Dynamometers.
2. Study and use of Pressure pickups, charge amplifier, storage oscilloscope and signal analyzers used for IC engine testing.
3. Performance study of petrol engine at full throttle and part throttle conditions.
4. Performance study of diesel engine both at full load and part load conditions.
5. Morse test on petrol and diesel engines.
6. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in IC engines.
7. Head balance test on an automotive diesel engine.

Study of the following devices for Automotive Application

- Logic gates, Adders, Flip flops
- SCR and IC Timers
- Interfacing seven segment displays
- Study of Microprocessor and Microcontrollers
- Interfacing Sensors like RTD, LVDT, Load Cell etc.
- Interfacing ADC for Data Acquistion
- Interfacing DAC for Control Application
- Interfacing Actuators
- EPROM Programming

TOTAL : 45 PERIODS

PTAU 9351 **VEHICLE DESIGN** **L T P C**
3 0 0 3

AIM:

This course gives a complete procedure for designing different kinds of chassis components in automobile engineering.

OBJECTIVES:

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

UNIT – I VEHICLE FRAME AND SUSPENSION 9

Study of loads - moments and stresses on frame members. Design of frame for passenger and commercial vehicle - design of leaf springs - Coil springs and torsion bar springs.

UNIT – II FRONT AXLE AND STEERING SYSTEMS 9

Analysis of loads - moments and stresses at different sections of front axle. Determination of bearing loads at Kingpin bearings. Wheel spindle bearings. Choice of bearings. Determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering. Design of Front Axle Beam.

UNIT – III CLUTCH 9

Torque capacity of single plate, multi plate and cone clutch. Design of clutch components, Design details of roller and sprag type of clutches. .

UNIT – IV GEAR BOX 9

Gear train calculations, layout of gear box constant mesh and synchrono mesh gear box. Design of three speeds and four speed gear boxes.

UNIT – V DRIVE LINE AND REAR AXLE 9

Design of propeller shaft and types 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. Design aspects of final drive.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Heldt,P.M., Automotive Chassis, Chilton Book Co., 1992.

2. Heldt,P.M., Torque Converters, Chilton Book Co., 1992.

REFERENCES:

1. Dean Averns., Automobile Chassis Design, Illife Book Co., 1982.

2. Giri,N.K., Automobile Mechanics, Khanna Publishers, New Delhi, 1998.

3. The Automotive Chassis: Engineering Principles, SAE – Sep., 1995.

PTAU 9401 VEHICLE DYNAMICS L T P C
3 0 0 3

OBJECTIVE:

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

UNIT – I INTRODUCTION 9

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

UNIT – II MULTI DEGREE FREEDOM SYSTEMS 9

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

UNIT – III NUMERICAL METHODS 9

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

UNIT – IV VEHICLE HANDLING AND STABILITY OF VEHICLES 9

Load distribution, calculation of acceleration, tractive effort and reactions for different drives, stability of a vehicle on a curved track, slope and a banked road. Oversteer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering.

UNIT – V SUSPENSION, TYRES 9

Requirements, sprung mass frequency, wheel hop, wheel wobble, wheel shimmy, choice of damper characteristics and suspension spring rate, calculation of effective spring rate, vehicle suspension in fore and aft direction, roll axis and vehicle under the action of side forces. Tyre – Requirements, types, testing, dynamics, ride characteristics, power consumed by a tyre.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Rao J.S and Gupta. K “Theory and Practice of Mechanical Vibrations”, Wiley Eastern Ltd., 2002.
2. Gillespie, T.D., Fundamentals of vehicle dynamics society of Automotive Engineers, USA, 1992.

REFERENCES:

1. Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication - 2002.
2. Ellis.J.R - “Vehicle Dynamics”- Business Books Ltd., London- 1991
3. Heldt,P.M., Automotive Chassis, Chilton Co., New York, 1992.
4. Giles,J.G., Steering, Suspension and Tyres, Illiffe Books Ltd., London, 1988.
5. W. Steeds: Mechanics of road vehicles, illiffe books ltd, London, 1960

6. Giri N.K – Automotive Mechanics, Khanna Publishers, 2007.

PTAU 9404 VEHICLE MAINTENANCE AND RE–CONDITIONING 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. Cylinder reboring – checking the cylinder bore, Setting the tool and reboring.
4. Valve grinding, valve lapping - Setting the valve angle, grinding and lapping and checking for valve leakage
5. Calibration of fuel injection pump
6. Minor and major tune up of gasoline and diesel engines
7. Study and checking of wheel alignment - testing of camber, caster.
8. Testing kingpin inclination, toe-in and toe-out.
9. Brake adjustment and Brake bleeding.
10. Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.
11. Battery testing and maintenance.
12. Practice the following:
    i) Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play
    ii) Air bleeding from hydraulic brakes, air bleeding of diesel fuel system
    iii) Wheel bearings tightening and adjustment
    iv) Adjustment of head lights beam
    v) Removal and fitting of tyre and tube

TOTAL : 45 PERIODS

PTAU9402 **VEHICLE MAINTENANCE** **L T P C**
3 0 0 3

OBJECTIVE:

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

UNIT – I MAINTENANCE RECORDS AND SCHEDULE 9

Importance of maintenance. Scheduled and unscheduled maintenance. Preparation of check lists. Chassis lubrication. Cost effectiveness. Pre-trip, Post-trip. Inspection forms. Log books. Trip sheets. Other maintenance record forms.

UNIT – II MAINTENANCE, REPAIR AND OVERHAULING OF ENGINE 9

Dismantling of engine components. Cleaning methods. Visual inspection and dimensional check of various engine components. Minor and Major tune up Reconditioning, repairing methods of engine components. Assembly procedure. Special tools used for maintenance, repair and overhauling.

UNIT – III MAINTENANCE, REPAIR AND OVERHAULING OF CHASSIS DRIVE LINE COMPONENTS 9

Clutch – Mechanical, Automatic types. Gear box – Mechanical, Automatic types. Final reduction. Propeller shaft. Front and rear suspension system. Rigid and independent types. Brakes systems – Hydraulic, Servo, Air. Air bleeding. Steering system. Wheel alignment. Types.

UNIT – IV MAINTENANCE, REPAIR AND SERVICING OF ELECTRICAL SYSTEMS 9

Battery – Testing methods. Starter motor. Charging system – DC Generator, AC Alternator, Regulator. Ignition systems – Coil ignition, Transistor assisted ignition, Capacitor discharge ignition. Electric Horn, Wiper, Flasher, Electric fuel pump, Gauges. Lighting system. Head lights focusing. Wiring system.

UNIT – V MAINTENANCE, REPAIR AND SERVICING OF COOLING LUBRICATION SYSTEM, FUEL SYSTEM AND BODY 9

Cooling system – types, water pump, radiator, thermostat valve, anti corrosion and anti freezing solutions. Lubricating system – Oil analysis, oil topping up, oil change, oil filters, oil relief valve. Fuel system – Petrol, diesel fuel feed system components. Body repair tools, minor body panel beating, tinkering, soldering, polishing, painting. Door locks mechanism. Window glass actuating mechanism.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Judge, A.N., Motor vehicle engine servicing, 3rd Edition, Pitman Paper pack, London, ‘69.
2. Venk. Spicer, Automotive Maintenance and Trouble shooting.

REFERENCES:

1. John Doke, Fleet management, McGraw Hill Co., 1984.
2. Judge,A.W., Maintenance of High speed diesel engines, Chapman Hall Ltd., London, ’56.
3. Maleev,V.L., Diesel Engine operation and Maintenance, McGraw Hill Book Co., New York, 1954.
4. John.W.Vale.J.R., Modern Auto Body and Fender repair.
5. Vehicle Service Manuals of reputed manufacturers.

PTAU9305 AUTOMOTIVE POLLUTION AND CONTROL L T P C
3 0 0 3

OBJECTIVE:

The main objective of this course is to impart knowledge in automotive pollution control. The detailed concept of formation and control techniques of pollutants like UBHC, CO, NO_x, particulate matter and smoke for both SI and CI engine will be taught to the students. The instruments for measurement of pollutants and emission standards will also be introduced to the students. At the end of the course the students will have command over automotive pollution and control.

UNIT – I INTRODUCTION 6

Pollutants – sources – formation – effects – transient operational effects on pollution – Standards for Emission of pollutants.

UNIT – II S.I. ENGINE COMBUSTION AND EMISSIONS 11

Chemistry of SI engine combustion – HC and CO formation in 4-stroke and 2-stroke SI engines – NO formation in SI engines – Particulate emissions from SI engines – Effect of operating variables on emission formation.

UNIT – III CI ENGINE COMBUSTION AND EMISSIONS 10

Basics of diesel combustion – Smoke emission in diesel engines – NO emission from diesel engines – Particulate emission in diesel engines. Color and Aldehyde emissions from diesel engines – effect of operating variables on emission formation.

UNIT – IV CONTROL TECHNIQUES FOR REDUCTION OF SI AND CI ENGINE EMISSION 9

Design changes – Optimization of operating factors – Exhaust gas recirculation – Fumigation – Air injector PCV system – Exhaust treatment in SI engines – Thermal reactors – Catalytic converters – Catalysts – Use of unleaded petrol.

UNIT – V TEST PROCEDURE & INSTRUMENTATION FOR EMISSION MEASUREMENT AND EMISSION STANDARDS 9

Test procedures – NDIR analyzer – Flame ionization detectors – Chemiluminescent analyser – Gas chromatograph – Smoke meters – Emission standards.

TOTAL : 45 PERIODS

TEXT BOOK

1. Springer and Patterson, Engine Emission, Plenum Press, 1990.

REFERENCES

1. Ramalingam. K.K., Internal Combustion Engines, Scitech Publications, Chennai, 2003.
2. Ganesan,V., Internal Combustion Engines, Tata McGraw Hill Co., 1994.
3. SAE Transactions, Vehicle emission, 1982 (3 volumes).
4. Obert,E.F., Internal Combustion Engines, 1982.
5. Taylor,C.F., Internal Combustion Engines, MIT Press, 1972.
6. Heywood,J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co., 1995.
7. Automobiles and Pollution SAE Transaction, 1995.

PTAU9451	PROJECT WORK	L T P C 0 0 12 6

The objective of project work is to enable the students, to work in convenient groups of not more than four members in a group, on a project involving some design and fabrication work or theoretical and experimental studies related to the respective engineering discipline.

Every project work shall have a Guide who is a member of the faculty of the University. Twelve periods per week shall be allotted in the Time table for this important activity and this time shall be utilized by the students to receive 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 or viva to review the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details, estimation of cost and conclusions. This final report shall be in typewritten form as specified in the guidelines.

The continuous assessment and semester evaluation may be carried out as specified in the guidelines to be issued from time to time.

PT AU 9021 **AUTOMOTIVE AERODYNAMICS** **L T P C**
3 0 0 3

OBJECTIVE:

The main objective of the course is to introduce the importance of vehicle aerodynamics in the design of vehicle bodies. After the complete understanding of the optimization techniques, the students can have the ability to design aerodynamically stable vehicles.

UNIT – I INTRODUCTION 10

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

UNIT – II AERODYNAMIC DRAG OF CABS 8

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

UNIT – III SHAPE OPTIMIZATION OF CABS 7

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

UNIT – IV VEHICLE HANDLING 10

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

UNIT – V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS 10

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

TOTAL : 45 PERIODS

TEXTBOOK:

1. Hucho, W.H., Aerodynamics of Road vehicles, Butterworths Co. Ltd., 1997.

REFERENCES:

1. Pope, A, Wind Tunnel Testing, John Wiley & Sons, 2nd Edn., New York, 1994.

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

PT AU 9022 ALTERNATE FUELS AND ENERGY SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

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

UNIT – I INTRODUCTION 06

Estimation of petroleum reserve "World Energy Scenerio, Energy Survey of India" – Need for alternate fuel – Availability of alternate fuels.

UNIT – II ALCOHOLS 09

Properties as engine fuels, alcohols and gasoline blends, performance in SI engine. Methanol and gasoline blends – Combustion characteristics in engines – emission characteristics.

UNIT – III NATURAL GAS, LPG, HYDROGEN AND BIOGAS 09

Availability of CNG, properties, modification required to use in engines – performance and emission characteristics of CNG and LPG in SI & CI engines. Performance and emission for LPG – Hydrogen – Storage and handling, performance and safety aspects.

UNIT – IV VEGETABLE OILS 10

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

UNIT – V ELECTRIC AND SOLAR POWERED VEHICLES 11

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

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Ramalingam. K.K., Internal combustion engine, scitech publications, Chennai, 2003.
2. Maheswar Dayal, Energy today & tomorrow, I & B Horishr India, 1982.
3. Bechtold,R.L., Alternative Fuels Guide Book, SAE, 1997.

REFERENCES:

1. Nagpal, Power Plant Engineering, Khanna Publishers, 1991.
2. Alcohols and motor fuels progress in technology, Series No.19, SAE Publication USA 1980.
3. SAE Paper Nos.840367, 841156, 841333, 841334.
4. The properties and performance of modern alternate fuels – SAE Paper No.841210.

PT AU 9023 **SPECIAL TYPES OF VEHICLES** **L T P C**
3 0 0 3

OBJECTIVE:

The main objective of this course is to introduce the concept and principle of operation of special vehicles such as Bulldozers, Ditchers, Bucket excavators etc. At the end of the course, the students can have a better understanding of the application of the special types of vehicles in the excavation of earth.

UNIT – I EARTH MOVING AND CONSTRUCTIONAL EQUIPMENTS 11

Construction layout, capacity and applications of earthmovers like dumpers, front-end loaders, bulldozers, excavators, backhoe loaders, scrappers, motor graders etc. criteria for selection of prime mover fro dumpers and front end loaders based on vehicle performance characteristics.

UNIT – II POWER TRAIN CONCEPTS 07

Engine – converter match curves. Hauling & cyclic type transmissions. Selection criteria for universal joints. Constructional details of steerable and drive axles of dumper.

UNIT – III VEHICLE SYSTEMS, FEATURES 11

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

UNIT – IV SPECIAL PURPOSE VEHICLES FOR INDUSTRIAL APPLICATIONS 08

Constructional features, capacity and stability of jib cranes. Vibratory compactors.

UNIT – V FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES 08

Ride and stability characteristics, power take off, special implementations. Special features and constructional details of tankers, gun carriers and transport vehicles.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Abrosimov. K. Bran berg.A. and Katayer.K., "Road making Machinery", MIR Publishers, Moscow, 1971.
2. SAE Handbook Volume III
3. Wong.J.T., " Theory of Ground vehicles ", John Wiley & Sons, New York, 1987.

REFERENCES:

1. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.
2. Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998.
3. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co ltd., London.
4. Astokhov, Truck Cranes, MIR Publishers, Moscow.

PT AU 9024 **TRACTOR AND FARM EQUIPMENTS** **L T P C**
3 0 0 3

OBJECTIVE:

The objective of this course is to impart knowledge in the concept and operation of Tractors and other allied farm equipments. The course is highly useful for the students who are interested to work in the manufacturing sector of Tractors and in Agricultural field.

UNIT – I GENERAL DESIGN OF TRACTORS 10

Classification of tractors – Main components of tractor – Safety rules.

UNIT – II CONTROL OF THE TRACTOR AND FUNDAMENTALS OF ENGINE OPERATION 10

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

UNIT – III ENGINE FRAME WORK AND VALVE MECHANISM OF TRACTOR 10

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

UNIT – IV COOLING SYSTEM, LUBRICATION SYSTEM AND FUEL SYSTEM OF A TRACTOR 10

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

UNIT – V FARM EQUIPMENTS 05

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

TOTAL : 45 PERIODS

TEXTBOOK:

Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.

REFERENCE:

Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor, MIR Publishers, 1972.

PT AU 9025 VEHICLE AIR–CONDITIONING L T P C
3 0 0 3

OBJECTIVE:

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

UNIT – I AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS 10

Basic air conditioning system – Components – types of Compressor, Condenser, Expansion devices and Evaporators. Location of air conditioning components in a car – Schematic layout of a air conditioning system. Compressor components – Thermostatic expansion valve & orifice tube – Expansion valve calibration – Evaporator temperature controls for TXV & CCOT systems.

UNIT – II REFRIGERANT 09

Requirements for refrigerants – Classification of refrigerants- Refrigerant selection- Storage of refrigerants – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

UNIT – III AIR CONDITIONER – HEATING SYSTEM 10

Manually controlled air conditioner – Heater system – Ford automatically controlled air conditioner – heater systems – Chrysler automatically controlled air conditioner – Heater system, General Motors automatically controlled air conditioner – Heater system – Flushing & Evacuating.

UNIT – IV AIR ROUTING & TEMPERATURE CONTROL 10

Objectives – Evaporator case air flow through the Dash recirculating unit – Automatic temperature control – Ducting system in Passenger car and Bus– Controlling flow – Vacuum reserve – Testing the air control and handling systems- Load calculations - Psychrometry

UNIT – V HEATER – AIR CONDITIONER TROUBLE SHOOTING & SERVICE 06

Air conditioner maintenance and service – Servicing heater system. Removing and replacing components. Trouble shooting of air conditioner – heating system – Compressor service.

TOTAL : 45 PERIODS

TEXT BOOK:

1. William H Crouse and Donald L Anglin, Automotive Air conditioning, McGraw Hill Inc., 1990.

REFERENCES:

1. Mitchell Information Services, Inc., Mitchell Automatic Heating and Air Conditioning Systems, Prentice Hall Inc., 1989.
2. Paul Weisler, Automotive Air Conditioing, Reston Publishing Co. Inc., 1990.
3. McDonald,K.L., Automotive Air Conditioning, Theodore Audel series, 1978.

Goings,L.F., Automotive Air Conditioning, American Technical services, 1974.

PTAU 9026 **AUTOMOTIVE SAFETY** **L T P C**
3 0 0 3

OBJECTIVE:

At the end, the student will have good exposure to Automotive safety aspects including safety equipments.

UNIT – I INTRODUCTION 9

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

UNIT – II SAFETY CONCEPTS 9

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

UNIT – III SAFETY EQUIPMENTS 9

Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety, antiskid braking system, regenrative braking system, speed control devices.

UNIT – IV COLLISION WARNING AND AVOIDANCE 9

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

UNIT – V COMFORT AND CONVENIENCE SYSTEM 9

Steering and mirror adjustment, central locking system , Garage door opening system, tyre pressure control system, rain sensor system, environment information system, manual and automated wiper system, satellite control of vehicle operation for safe and fast travel.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Bosch - “Automotive Handbook” - 5th edition - SAE publication - 2000.

REFERENCES:

1. J.Powloski - “Vehicle Body Engineering” - Business books limited, London - 1969.
2. Ronald.K.Jurgen - “Automotive Electronics Handbook” - Second edition- McGraw-Hill Inc., - 1999.
3. ARAI Safety standards.

PT AU 9027 RUBBER TECHNOLOGY FOR AUTOMOBILES L T P C
3 0 0 3

UNIT – I INTRODUCTION 06

Identification of plastics/rubber components in automobiles - function - selection criteria.

UNIT – II STRUCTURE-PROPERTY RELATIONSHIP OF RUBBER 10

Resilience, creep, hysteresis and damping, stability, set and stress relaxation, behavior in dynamic applications.

UNIT – III VIBRATION AND RUBBER SPRING 10

Principle of vibration isolation – rubber mounts – spring design – comparison with metallic springs – shape factor and its effect – forced and free vibrations with damping – typical mounts, compounding and manufacture.

UNIT – IV FLUID SEALINGS AND FLEXIBLE COUPLINGS AND HOSES 10

Seals for static and dynamic applications – effect of heat / oil ageing – frictional behavior – fundamental of seal ability.

UNIT – V COMPOUNDING AND MANUFACTURE 09

Types of couplings – specification and selection – torque vs deflection relationships – brake fluid / hydraulic hoses, materials and manufacture.

TOTAL : 45 PERIODS

TEXTBOOK:

1. Freakley,P.K., and Payne,A.R., Theory and Practice of Engineering with Rubber, Applied Science Publishers Ltd.

REFERENCES:

1. Hobel,E.F., Rubber Springs Design.
2. Blow,C.M. and Hepburn,C., Rubber Technology and Manufacture.

PT AU 9028	FLEET MANAGEMENT	L T P C 3 0 0 3

UNIT – I MANAGEMENT TRAINING AND OPERATIONS 10

Basic principles of supervising. Organising time and people. Job instruction training – Training devices and techniques – Drive and mechanic hiring – Driver checklist – Lists for driver and mechanic – Trip leasing – Vehicle operation and types of operation.

UNIT – II VEHICLE MAINTENANCE 08

Scheduled and unscheduled maintenance – Planning and scope – Evaluation of PMI programme – Work scheduling – Overtime – Breakdown analysis – Control of repair backlogs – Cost of options.

UNIT – III VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET 10

Cost of inventory – Balancing inventory cost against downtime – Parts control – Bin tag systems – Time management – Time record keeping – Budget activity – Capital expenditures – Classification of vehicle expenses – Fleet management and data processing – Data processing systems – Software. Models – Computer controlling of fleet activity – Energy management.

UNIT – IV SCHEDULING AND FARE STRUCTURE 10

Route planning – Scheduling of transport vehicles – Preparation of timetable, Costs, fare structure – Methods of fare collection – Preparation of fare table.

UNIT – V MOTOR VEHICLE ACT 07

Schedules and sections – Registration of motor vehicles – Licensing of drivers – Control of permits – Limits of speed – traffic signs – Constructional regulations – Description of goods carrier, delivery man, tanker, tipper, Municipal, fire fighting and break down service vehicle.

TOTAL : 45 PERIODS

TEXTBOOK:

1. John Dolu, Fleet management, McGraw Hill Co., 1984.

REFERENCES:

1. Government Publication, The Motor vehicle Act, 1989.
2. Kitchin,L.D., Bus operation, Illiffe and Sons Ltd., London, III Edition, 1992.
3. Kadiyali,L.R., Traffic engineering and Transport Planning.

AU9029 AUTOMOTIVE TEST INSTRUMENTATION L T P C
3 0 0 3

UNIT – I MEASUREMENT SYSTEMS 06

Static and Dynamic Measurement systems- Requirements and characteristics – Analysis of experimental detail.

UNIT – II TRANSDUCERS, MODIFIERS AND TERMINATING DEVICES 08

Transducers for Automotive Applications – Amplifiers- filters –data Acquisition- Indicators, Printers and displays –Signal Analyzing.

UNIT – III MECHANICAL MEASUREMENT 10

Instrumentation for Measuring Weight, Force, torque, pressure power, temperature, fluid flow, vibration, rotational speed, velocity, acceleration and angular motion.

UNIT – IV ENGINE EXPERIMENTAL TECHNIQUES 12

I.S Code for Engine testing – Instrumentation for performance testing of engine, Instrumentation for Research and development, Instrumentation for noise, vibration, in cylinder gas flow, flame temperature Dynamic Cylinder pressure measurements

UNIT – V VEHICLE EXPERIMENTAL TECHNIQUES 09

Laboratory tests- test tracks - Endurance Tests- crash tests- wind tunnel tests- Brake tests.

TOTAL : 45 PERIODS

REFERENCES:

1. A.W. JUDGE, Engineering Precision Measurement, Chapman and Hall Ltd, Essex Street W.C.,1951,
2. T.G. Beckwith and Buck, Mechanical Measurements, Oxford and IBH Publishing House, New Delhi, 1995
3. D.Patambis, Principle of Industrial Instrumentation, Tata McGraw Hill Publishing Co, New Delhi, 1990.
4. Rangan, Sharma and Mani, Instrumentation Devices and systems, Tata McGraw Hill Publishing Co., Ltd., 1990
5. J.G. Giles, Engine and Vehicle Testing, Illiffe books Ltd., London,1968.

PT AU 9030	ADVANCED PRODUCTION PROCESSES FOR AUTOMOTIVE COMPONENTS	L T P C 3 0 0 3

UNIT – I POWDER METALLURGY 08

Process flow chart – Production of metal powders and their raw materials – Manufacture of friction lining materials for clutches and brakes – Testing and inspection of PM parts.

UNIT – II FORMING PROCESS 15

Forging – process flow chart, forging of valves – connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles. Extrusions: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Hydroforming: Process, hydroforming of manifold and comparison with conventional methods – Hydro forming of tail lamp housing. Stretch forming – Process, stretch forming of auto body panels – Super plastic alloys for auto body panels.

UNIT – III GEAR MANUFACTURING 08

Different methods of Gear manufacture – Gear hobbing and gear shaping machines specifications – gear generation – different methods – gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching.

UNIT – IV CONCEPT & PROGRAMMING OF CNC MACHINES 08

NC, CNC & DNC - types of CNC - constructional features – drives and control systems - feed back devices – manual part programming – steps involved – sample program in Lathe & milling.

UNIT – V RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS 06

Powder injection moulding – Shotpeen hardening of gears – Production of aluminium MMC liners for engine blocks – Plasma spray coated engine blocks and valves – Recent developments in auto body panel forming – Squeeze casting of pistons – aluminium composite brake rotors.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Heldt, P.M., High Speed Combustion Engines, Oxford Publishing Co., New York, 1990.

REFERENCES:

1. Haslehurst,S.E., Manufacturing Technology, ELBS, London, 1990.
2. Rusinoff, Forging and Forming of metals, D.B. Taraporevala Son & Co. Pvt.Ltd., Mumbai, 1995.
3. Subroff,A.M. & Others, Forging Materials & Processes, Reinhold Book Corporation, New York, 1988.
4. High Velocity Forming of Metals, ASTME, Prentice Hall of India (P) Ltd., New Delhi, 1990.
5. Groover.M.P.,Automatic production systems and computer integrated manufacturing, Prentice-Hall, 1990.
6. GE Thyer, Computer Numerical Control of Machine Tools, BH.Newners,1991.

PT AU 9031 COMBUSTION THERMODYNAMICS AND HEAT TRANSFER L T P C
3 0 0 3

UNIT – I INTRODUCTION TO COMBUSTION PROCESSES 10

Definition for Fuel and Oxidizer – types – Various combustion modes- Combustion in premixed laminar and premixed turbulent combustion - Flame Speed – Burning Velocity - diffusion flames – Combustion process in IC engines.

UNIT – II THERMODYNAMICS OF COMBUSTION 11

Thermodynamics of combustion – Thermodynamic Properties – Ideal gas law – Gas mixture combustion – Stoichiometric combustion – Thermochemistry – Hess's law- Adiabatic flame temperature – Physics of combustion – Fick's law of species diffusion – Conservation equations – Boundary layer concept

UNIT – III NORMAL, ABNORMAL COMBUSTION IN SI ENGINES 7

Stages of combustion – Flame propagation –– Flame Limits –Flame Extinction -Rate of pressure rise – Cycle to cycle variation – Abnormal combustion – Theories of detonation – Effect of engine operating variables on combustion –Example problems.

UNIT – IV COMBUSTION AND HEAT TRANSFER IN IC ENGINES 11

Droplet and spray combustion theory – delay period – Peak pressure – Heat release – Gas temperature – Diesel knock. Basic definitions – Convective heat transfer – Radiative heat transfer – Heat transfer, temperature distribution and thermal stresses in piston – Cylinder liner – Cylinder head – fins and valves.

UNIT – V EXPERIMENTAL INVESTIGATION OF COMBUSTION AND HEAT TRANSFER IN IC ENGINES 6

Photographic studies of combustion processes – P-θ diagrams in SI and CI engines, Assembly – Temperature measurement in piston – cylinder liner – Cylinder head and engine valves.

TOTAL : 45 PERIODS

TEXT BOOK:

1. SPALDING.D.B., Some fundamentals of Combustion, Butterworth Science Publications, London, 1985.

REFERENCES:

1. Lewis,B., Pease,R.N. and Taylor,H.S., Combustion Process, High Speed Gas dynamics and Jet Propulsion Series, Princeton University Press, Princeton, New Jersey, 1976.
2. Taylor,E.F., The Internal Combustion Engines, International Text Book Co., Pennsylvania, 1982.
3. Ganesan,V., Internal Combustion Engines, Tata McGraw Hill Co., 1994.
4. D.P.Mishra.,Fundamentals of Combustion, PHI .,2008

PT AU 9032 ADVANCED THEORY OF IC ENGINES L T P C
3 0 0 3

OBJECTIVE:

The main objective of this course is to impart knowledge in advanced theory of IC engines. The detailed concept, of combustion Stoichiometry of various fuels, combustion modeling and analysis for both CI and SI engines and non conventional engines will be taught to the students. At the end of the course the students will have command over advances in IC engines

UNIT – I INTRODUCTION 07

Fuel air cycle and Actual cycle analysis, Properties of IC engine fuels, Refining process, chemical composition and molecular structure of fuels, octane number, cetane number. Knock rating of SI engine fuels.

UNIT – II COMBUSTION OF FUELS 12

Combustion Stoichiometry of petrol, diesel, alcohol and hydrogen fuels – Chemical energy and heating values – Chemical equilibrium and maximum temperature – SI engine combustion – Flame velocity and area of flame front –performance number – CI engine combustion. Fuel spray characteristics – droplet size, penetration and atomization.

UNIT – III COMBUSTION MODELLING 10

Basic concepts of engine simulation – Governing equations, thermodynamic models – SI engine and CI engine models.

UNIT – IV NON-CONVENTIONAL IC ENGINES 08

Adiabatic and L.H.R. engines – Variable compression ratio engine – Wankel rotary combustion engine – Free piston engine - MAN combustion chamber and multi fuel engines – Stratified charge and lean burn engines – Locomotive and marine engines.

UNIT – V COMBUSTION ANALYSIS IN IC ENGINES 08

Photographic studies of combustion processes – P-θ diagrams in SI and CI engines, Rate of heat release – hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines

TOTAL : 45 PERIODS

TEXTBOOK:

1. Ganesan,V., Internal combustion engines, Tata McGraw Hill Publishing Co., 1994.

REFERENCES:

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

PT AU 9033 COMPUTER INTEGRATED MANUFACTURING SYSTEMS L T P C
3 0 0 3

UNIT – I INTRODUCTION TO CAD 08

Fundamental concepts in manufacturing and automation – Need for automation – Automation stages – Economic analysis and production – Fundamentals of CIMS. Elements of CAD system – Graphics hardware – ALU – CPU – Input/Output devices – Geometric modeling – Automated drafting

UNIT – II MANUFACTURING SYSTEMS 10

Basics of numerical control – Types of NC systems – CNC and DNC machines – Machining centre – Tool magazine – NC tape format – Programming – Manual part programme – Simple programmes – Computer assisted part programming – APT language – Simple examples

UNIT – III FLEXIBLE MANUFACTURING SYSTEMS 09

Group technology – Part families – Part classification and coding – Production flow analysis – Machine cell design – Description of FMS – Equipment, Tooling and fixture. Design for Manufacturing and Assembly - Process Planning Techniques - Total approach to product development - Concurrent Engineering – Rapid prototyping

UNIT – IV COMPUTER AIDED MANUFACTURING 09

Computers in manufacturing – Automated manufacturing systems – Work piece handling – Types of transfer – Continuous, Intermittent and Non-synchronous walking beam – Computer aided process planning – Computer aided inspection – Computer aided quality control – Basic model of CIMS – Interfacing methods of CAD and CAM – Computer Process Monitoring.

UNIT – V PRODUCTION PLANNING AND CONTROL 09

Introduction to production planning and control - Shop Floor Control Systems - Just in time approach - Emerging Challenges in CAD / CAM, Product Data Management - Product Modeling - Assembly and Tolerance Modeling.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Groover,M.P., Automation Production Systems and CAM, Prentice Hall, 1990.
2. Ibrahim Zeid, " CAD - CAM Theory and Practice ", Tata McGraw-Hill Publishing Co. Ltd., 1998.

REFERENCES:

1. Groover,M.P., CAD/CAM Computer Aided Design and Manufacturing, Prentice Hall, 1990.
2. gg S.Kant Vajpayee, , " Principles of Computer Integrated Manufacturing ", Prentice Hall of India Ltd., 1999
3. Barry Hawker, CAD/CAM Processes, Pitman, 1988.
4. Niebel, Modern Manufacturing Process Engineering, McGraw Hill, 1989.
5. Martin,S.J., Numerical control of Machine Tools, ELBS, London, 1980.
6. Weatherhall,A., Computer Integrated Manufacturing, Affiliated East-West, 1988.

PT AU 9034 THEORY AND DESIGN OF JIGS AND FIXTURES L T P C
3 0 0 3

OBJECTIVE:

- To introduce the concepts of various types of jigs, fixtures and dies.
- To design and draw jig / fixture/ die for a given component.

UNIT – I LOCATION AND CLAMPING DEVICES IN JIGS AND FIXUTRES 09

Definitions of Jigs and Fixtures – Principles of Jigs and Fixtures design – Preliminary analysis and planning of jigs and fixture parts and their materials – Basic steps in the design of jigs and fixtures – Different types of locating devices – different types of clamps – Drill bushes – types – Elements of fixtures – Advantages of Jigs & Fixtures.

UNIT – II DESIGN OF ELEMENTS OF JIGS AND FIXTURE 09

Design concepts of Template Jig, Plate Jig, Sandwich Jig, Vice Jaw Jig, Latch Jig, Turnover jig, Box jig – Fixtures for Milling, Grinding, Turning, Welding, and Assembly – Modular fixtures.

UNIT – III PRESS WORKING OPERATION AND FORMING DIES 09

Blanking, Piercing, lancing, notching, bending design features of dies for drawing, extrusion, wire drawing and forging.

UNIT – IV ELEMENTS OF DIE 09

Design concepts of the following elements of progressive, compound and Combination dies – Die block – Die shoe – Bolster plate – punch – punch plate – punch holder – guide pins and guide bushes – strippers – knockouts – stops - pilots – selection of standard die sets – strip layout and development.

UNIT – V DESIGN AND DRAWING DIES, JIGS AND FIXTURES 09

Progressive die – compound die – Bending and drawing dies – Drill Jigs – Milling fixtures, turning fixtures.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Donaldson, B.H. Lecain, Goold V.V., Tool Design, TMH Edition, 1978.

REFERENCES:

1. Handbook of metal forming, Kurt Lunge, McGraw Hill, Pub.Co. 1985.
2. Paquin, Die Design Fundamentals, Industrial Press Inc, New York, 1979
3. ASTME, Fundamentals of Tool design, Prentice Hall 1974
4. Kempster M.H.A., Introduction to Jigs and Fixtures, ELBS Edition, 1976

PT AU 9035 HYDRAULIC AND PNEUMATIC SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

The objective of this course is to introduce the essential principles of hydraulic and pneumatic system and related automobile applications.

UNIT – I INTRODUCTION 06

Introduction to fluid power, properties - hydraulic fluids, air. Selection of hydraulic fluids, comparison between hydraulics and pneumatics. Symbols of pneumatic elements and hydraulic elements.

UNIT – II PNEUMATIC SYSTEMS 12

Basic requirement of pneumatic system. Elements of pneumatics, constructional details of air compressors, air motors, control valves, actuators and mountings, filter, lubricator, regulator. General approach of system design, travel step diagram. Types - sequence control, cascade, step counter method. K.V.Mapping for minimization of logic equation. Simple circuits.

UNIT – III HYDRAULIC SYSTEMS 12

Pumps and motors- types, characteristics. Cylinders, types, construction details. Valves for control of direction, flow and pressure, types, construction details. Power pack– elements, design. Pipes- material, pipe fittings. seals and packing. Maintenance of hydraulic systems. Selection criteria for cylinders, valves, pipes.

UNIT – IV ADVANCED TOPICS IN HYDRAULICS AND PNEUMATICS 09

Electro pneumatics, ladder diagram. Servo and Proportional valves - types, operation, application. Hydro-Mechanical servo systems. PLC-construction, types, operation, programming.

UNIT – V AUTOMOTIVE APPLICATIONS 06

Hydraulic tipping mechanism, power steering, fort lift hydraulic gear, hydro-pneumatic suspension, air brake and maintenance and trouble shooting of pneumatic circuits.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Anthony Espisito, " Fluid Power with Application", Pearson Education (Singapore) Pte.Ltd, Delhi, India, Fifth Edition, First Indian Reprint, 2003
2. Werner Deppert and Kurt Stoll, "Pneumatic Controls : An introduction to principles", Vogel-Druck Wurzburg, Germany, 1975
3. Pippenger, J.J, "Industrial Hydraulic & Pneumatics", McGraw Hill, 2002.

REFERENCES:

1. Majumdar, S.R., "Oil Hydraulic Systems: Principles and Maintenance", Tata McGraw- Hill Publishing Company Ltd., New Delhi, Fourth Reprint, 2003.
2. Peter Rohner, "Fluid Power Logic Circuit Design – Analysis, Design Method and Worked Examples", The Macmillan Press Ltd., UK, 1979.
3. Festo KG, "Pneumatic Tips", Festo, Germany, 1987.
4. Andrew Parr, "Hydraulic and Pneumatics", Jaico publishing house, 1999.

PTGE 9021 **PROFESSIONAL ETHICS IN ENGINEERING** **L T P C**
3 0 0 3

UNIT – I ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT – II ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study.

UNIT – III ENGINEER'S RESPONSIBILITY FOR SAFETY 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal.

UNIT – IV RESPONSIBILITIES AND RIGHTS 9

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 9

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

TOTAL :45 PERIODS

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, (2000).

REFERENCES:

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
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)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003)

PTGE 9022 **TOTAL QUALITY MANAGEMENT** **L T P C**
3 0 0 3

UNIT – I INTRODUCTION 9

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

UNIT – II TQM PRINCIPLES 9

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

UNIT – III TQM TOOLS & TECHNIQUES I 9

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

UNIT – IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment)QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs -

UNIT – V QUALITY SYSTEMS 9

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

TOTAL: 45 PERIODS

TEXT BOOK:

1. Dale H Besterfiled, et al, “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint 92006)

REFERENCE BOOKS:

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

PT GE 9023 FUNDAMENTALS OF NANOSCIENCE L T P C
3 0 0 3

UNIT – I INTRODUCTION 10

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT – II PREPARATION METHODS 10

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT – III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 05

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

UNIT – IV PREPARATION ENVIRONMENTS 10

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

UNIT – V CHARECTERISATION TECHNIQUES 10

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

TOTAL : 45 PERIODS

TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES:

1. G Timp (Editor), “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor), “The Hand Book of Nano Technology,Nanometer Structure”, Theory, Modeling and Simulations”, Prentice-Hall of India (P) Ltd, New Delhi, 2007.

PT AE 9354 FINITE ELEMENT METHODS L T P C
3 0 0 3

UNIT – I INTRODUCTION 8

Review of various approximate methods – Raleigh Ritz's, Galerkin and finite difference methods- Governing equation and convergence criteria of finite element method.

UNIT – II DISCRETE ELEMENTS 10

Bar elements, uniform section, mechanical and thermal loading, varying section, truss analysis. Beam element - problems for various loadings and boundary conditions - longitudinal and lateral vibration. Use of local and natural coordinates.

UNIT – III CONTINUUM ELEMENTS 8

Plane stress, Plane strain and axisymmetric problems, constant and linear strain, triangular elements, stiffness matrix, axisymmetric load vector,

UNIT – IV ISOPARAMETRIC ELEMENTS 10

Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, Stiffness matrix and consistent load vector, Gaussian integration.

UNIT – V FIELD PROBLEM 9

Heat transfer problems, Steady state fin problems, Derivation of element matrices for two dimensional problems, Torsion problems.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Tirupathi.R. Chandrapatha and Ashok D. Belegundu - Introduction to Finite Elements in Engineering - Printice Hall India, Third Edition, 2003.
2. Rao.S.S., Finite Element Methods in Engineering, Butterworth and Heinemann, 2001

REFERENCES:

1. Reddy J.N. – An Introduction to Finite Element Method – McGraw Hill – 2000.
2. Krishnamurthy, C.S., Finite Element Analysis, Tata McGraw Hill, 2000.
3. Bathe, K.J. and Wilson, E.L., Numerical Methods in Finite Elements Analysis, Prentice Hall of India, 1985.
4. Robert D Cook, David S Malkus, Michael E Plesha, 'Concepts and Applications of Finite Element Analysis', 4th edition, John Wiley and Sons, Inc., 2003.
5. Larry J Segerlind, 'Applied Finite Element Analysis', Second Edition, John Wiley and Sons, Inc. 1984.

PT PR 9404	MANUFACTURING PROCESS PLANNING AND COST ESTIMATION	L T P C 3 0 0 3

AIM:

To evaluate a product in monetary units

OBJECTIVES:

(i) To develop a good process planner
(ii) To impart the knowledge on good estimation of engineering product

PRE-REQUISITES: Students must have sound knowledge on various manufacturing processes

UNIT – I PROCESS PLANNING 09

Definition - Information required and advantages - process planning activities and chart - logical design of a process plan (for machining process), covering preliminary analysis, selection of machining process, machine tools, grouping of jobs, Anteriorities table and anteriority matrix for sequencing.

Primary process selection – Rough and Refined rules - Selection of casting process – Selection of forming process – Selection of machining process – examples – Manual process planning – case studies – short comings of Manual process planning – Computer aided process planning – variant, generative and semi generative.

UNIT – II ESTIMATING, COSTING AND ELEMENTS OF COST 09

Importance and aims of cost estimation – Functions of estimation – costing – importance and aims of costing – Difference between costing and estimation – Importance of realistic estimates – Estimation procedure – Elements of cost – Material cost – Determination of Material cost – labour cost – determination of direct labour cost – Expenses – Cost of product (Ladder of cost) – Illustrative examples.

UNIT – III ANALYSIS OF OVERHEAD EXPENSES & METHODS OF DEPRECIATION 08

Overhead expenses – Factory expenses – Administrative expenses – Selling and Distributing expenses – Allocation of overhead expenses – Depreciation – Causes of depreciation – Methods of depreciation.

UNIT – IV ESTIMATION OF COSTS FOR FORGING, CASTING AND WELDING 10

Estimation of forging cost – Forging process – Forging operations – Losses in forging operations – Calculating forging cost – Illustrative examples – Estimation in Foundry shop – Introduction – Steps involved in making a casting – Patterns – Pattern allowances – Estimation of pattern cost – Foundry losses – Steps for calculating casting costs – Illustrative examples. Estimating welding costs - Introduction - Arc welding costs-Basic costing procedure (Arc welding) – Gas Welding – Basic costing procedure (Gas welding) – Factors affecting welding cost – Thermal cutting of Metals – Illustrative examples.

UNIT – V ESTIMATION OF MACHINING TIME AND ESTIMATION IN SHEET METAL SHOP 09

Estimation in Machine-shop – Introduction – Machining times and allowances – General term related to machining – calculation of machining time – Estimation of time for lathe operations – estimation of machining time for drilling, shaping, slotting, planing, grinding, and milling operations – Illustrative examples.

Estimation in sheet metal shop – Introduction – Development of product – sheet metal operations – sheet metal joints – Press working operations – Layout of blank – Press capacities – Estimation of time – Illustrative examples.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. O.P. Khanna, “Mechanical Estimating and Costing”, Dhanpat Rai publishers, 1999
2. R. Kesavan, C.Elenchezian, and B.Vijaya Ramnath, “Process Planning and cost estimation”, New age International publishers, 2005

REFERENCES:

1. G.B.S. Narang and V.Kumar, “Production and costing”, Khanna publishers, 2000
2. Mikell P. Groover, “Automation, production systems and computer – Integrated Manufacturing”, Prentice-Hall of India Private Limited, 2003
3. P. Radhakrishnan, S. Subramanyan and V. Raju, “CAD/CAM/CIM”, New Age International Publishers, 2000
4. Gideon Halevi & Roland D.Weill, “Principles of process planning”, Chapman & Hall, 1995.
5. M. Adithan & B.S. Pabla, “Production Engineering Estimating and costing”, Konark publishers Pvt. Ltd., 1990.