

**COURSE STRUCTURE IN AUTOMOBILE ENGINEERING
THIRD SEMESTER**

A. THEORY:

A. THEORY							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 301	Strength of Materials	3	0	0	3	3
2.	AUE 302	Fluid Mechanics and Machinery	3	1	0	4	4
3.	AUE 303	Engineering Thermodynamics	3	1	0	4	4
4.	AUE 304	Manufacturing Methods	3	0	0	3	3
5.	M 303	Mathematics	3	1	0	4	4
Total of Theory						18	18

B. PRACTICAL:

B. PRACTICAL							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 391	Strength of Materials Laboratory	0	0	3	3	2
2.	AUE 392	Fluid Mechanics and Machinery Laboratory	0	0	3	3	2
3.	AUE 394	Manufacturing Process Laboratory-I	0	0	3	3	2
4.	AUE 395	Graphics Laboratory –I	0	0	3	3	2
Total of Practical						12	8
Total of 3rd Semester						30	26

**COURSE STRUCTURE IN AUTOMOBILE ENGINEERING
FOURTH SEMESTER**

A. THEORY:

A. THEORY							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 401	Engineering Analysis and Numerical Methods	3	0	0	3	3
2.	AUE 402	Heat Transfer and Combustion	3	0	0	3	3
3.	AUE 403	Automotive Petrol Engines	3	0	0	3	3
4.	AUE 404	Theory of Machines	3	0	0	3	3
5.	AUE 405	Design of Machine Elements	3	0	0	3	3
6.	AUE 406	Measurements and Instrumentation.	3	0	0	3	3
Total of Theory						18	18

B. PRACTICAL:

B. PRACTICAL							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 492	Thermal Engineering Laboratory	0	0	3	3	2
2.	AUE 496	Measurements & Instrumentation Laboratory	0	0	3	3	2
3.	AUE 497	Manufacturing Process Laboratory-II	0	0	3	3	2
4.	AUE 498	Graphics Laboratory – II	0	0	3	3	2
Total of Practical						12	8

C. SESSIONAL:

C. SESSIONAL							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	HU 481	Technical Report Writing & / Language Practice Laboratory	0	0	3	3	2
Total of Sessional						3	2
Total of 4th Semester						33	28

- 4 week practical training at an Institute approved organization during vacation, at the end of fourth semester to be credited in fifth semester.

**COURSE STRUCTURE IN AUTOMOBILE ENGINEERING
FIFTH SEMESTER**

A. THEORY:

	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 501	Design of Mechanical Systems	3	1	0	4	4
2.	AUE 502	Automotive Diesel Engines	3	0	0	3	3
3.	AUE 503	Material Science & Technology	4	0	0	4	4
4.	AUE 504	Power Units and Transmission	4	0	0	4	4
5.	AUE 505	Automotive Chassis	3	0	0	3	3
Total of Practical						18	18

B. PRACTICAL:

B. PRACTICAL							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 591	Design Practice	0	0	3	3	2
2.	AUE 594	Engine Components Laboratory	0	0	3	3	2
3.	AUE 595	Chassis Components Laboratory	0	0	3	3	2
4.	AUE 597	Manufacturing Process Laboratory-III	0	0	3	3	2
Total of Practical						12	8

C. SESSIONAL:

C. SESSIONAL							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 599	Vacational Training					2
Total of Sessional							2
Total of 5th Semester						30	28

**COURSE STRUCTURE IN AUTOMOBILE ENGINEERING
SIXTH SEMESTER**

A. THEORY:

A. THEORY							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 601	Automotive Electrical Systems & Electronics	4	0	0	4	4
2.	AUE 602	Vehicle Body Engineering	3	0	0	3	3
3.	AUE 603	Two and Three Wheelers	3	0	0	3	3
4.	AUE 604	Automotive Pollution and Control	4	0	0	4	4
5.	AUE 605	Quality Control & Reliability Engineering	3	1	0	4	4
Total of Theory						18	18

B. PRACTICAL:

B. PRACTICAL							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 691	Automotive Electrical & Electronics Laboratory	0	0	3	3	2
2.	AUE 694	Engine Testing and Pollution Measurement Laboratory	0	0	3	3	2
3.	AUE 696	CAD Applications in Automotive Engineering - I	0	0	3	3	2
4.	AUE 697	Vehicle Maintenance Laboratory	0	0	3	3	2
Total of Practical						12	8

C. SESSIONAL:

C. SESSIONAL							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 699	Seminar	0	0	3	3	2
Total of Sessional						3	2
Total of 6th Semester						33	28

- Industrial training for 4 weeks as arranged by the Institute during vacation at the end of sixth semester, to be credited in the seventh semester.

**COURSE STRUCTURE IN AUTOMOBILE ENGINEERING
SEVENTH SEMESTER**

A. THEORY:

A. THEORY							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 701	Vehicle Dynamics	3	0	0	3	3
2.	AUE 702	Operations Research and Industrial Management	3	1	0	4	4
3.		Elective-I	3	0	0	3	3
4.	HU 701	Ethics in Engineering Profession	3	0	0	3	3
5.	HU 702	Engineering Economy & Financial Management	3	0	0	3	3
Total of Theory						16	16

B. PRACTICAL:

B. PRACTICAL							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 794	CAD Application in Automotive Engineering - II	0	0	3	3	2
2.	AUE 795	Project	0	0	9	9	6
Total of Practical						12	8

C. SESSIONAL:

C. SESSIONAL							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 798	Vacational Training					2
2.	AUE 799	Seminar on Assigned Topic	0	0	3	3	2
Total of Sessional						3	4
Total of 7th Semester						31	28

COURSE STRUCTURE IN AUTOMOBILE ENGINEERING**EIGHTH SEMESTER****A. THEORY:**

A. THEORY							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 801	Transport Management and Automobile Industry.	4	0	0	4	4
2.		Elective – II	4	0	0	4	4
3.		Elective - III	4	0	0	4	4
Total of Theory						12	12

B. PRACTICAL:

B. PRACTICAL							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 891	Auto Scanning & Vehicle Testing Laboratory	0	0	3	3	2
Total of Practical						3	2

C. SESSIONAL:

C. SESSIONAL							
	Code	Subjects	Contacts (Periods/week)				Credit points
			L	T	P	Total	
1.	AUE 898	Project / Thesis with Defence of Project	0	0	12	12	8
2.	AUE 881	Participation in Institutional Activities					2
3.	AUE 899	Comprehensive Viva-Voce					4
Total of Sessional						12	14
Total of 8th Semester						27	28

List of Elective Papers

Elective – I (Any one subject out the following):

AUE 711	Advanced Manufacturing Technology
AUE 712	Theory and Design of Jigs and Fixtures
AUE 713	Modern Vehicle Technology
AUE 714	Robotics and Robot Application
AUE 715	CAD/CAM and modern manufacturing methods
AUE 716	Tribology and Terotechnology

Elective – II (Any one subject out of the following):

AUE 811	Optimisation for Engineering Design
AUE 812	Tractors and Farm Equipment
AUE 813	Off-road Vehicles
AUE 814	Total Life Cycle Management
AUE 815	Computer Simulation of I.C Engine Processes
AUE 816	Non-Destructive Testing Methods
AUE 817	Industrial Engineering
AUE 818	Automotive Air-conditioning
AUE 819	Finite Element Method and its Application

Elective –III (Any one subject out of the following):

AUE 821	Alternate Fuels and Energy Systems
AUE 822	Micro Processor Application in Automobiles
AUE 823	Gas Turbine Engines
AUE 824	Management Information Systems
AUE 825	Total Quality Management
IT 806	Information Technology

SEMESTER-III

AUE 301 : Strength of Materials

Contacts : 3L

Credit : 3

Introduction: Internal forces, Stresses and strains, Elasticity, Hooke's law, Poisson's ratio, Elastic constants and their relationship. Stress-strain diagram for ductile materials. Definition of creep, fatigue and stress relaxation. Statically determinate and indeterminate problems. Thermal stress.

Bending of Beams: Shear force and bending moment diagrams for simply supported and cantilever beams. Pure bending. Bending stress in straight beams. Shear stresses in bending of rectangular and I-section beams.

Torsion and Columns: Torsion of circular shafts. Shear stresses and twist in solid and hollow shafts. Combined bending and torsion. Closely coiled helical springs. Definition of columns, Types of Columns, Euler's column formula, Equivalent length, Slenderness ratio, Rankine's formula.

Biaxial Stresses: Analysis of biaxial-stresses, Mohr's circle. Principal stresses and maximum shear stress-deductions from Mohr's circle. Stresses in thin walled pressure vessels.

Deflection of Beams: Differential equation of the elastic axis, double integration and moment methods. Strain energy in tension, compression, shear, bending and torsion. Castigliano's theorem.

References:

1. Timenshenko, S. And Young, D.H., Elements of Strength of Materials, T.Van Nostrand Co Inc., Princeton.N.J.1977.
2. Beer, F.P and Johnston, E.R., Mechanics of Materials, Tata McGraw Hill.2001
3. Ramamrutham, S., Strength of Materials, Dhanpat Rai Publishing Co. New Delhi.2004

AUE 302 : Fluid Mechanics and Machinery

Contacts : 3L + 1T

Credit : 4

Introduction: Classification of fluids. Properties of fluids: viscosity, Newton's laws of viscosity, surface tension, capillarity etc.

Fluid Statics: hydrostatic law, measurement of pressure with different manometers, Total pressure and Centre of pressure for Plane and curved surfaces, Buoyancy and stability of floating bodies, metacentric height .

Fluid Dynamics: Laws of kinematics of fluid flow. Lagrangian and Eulerian method. Convective and local acceleration, Stream line , Streak line and path line, concept of circulation and vorticity, Continuity equation in differential form, Stream function and potential functions with inter relations, concept of flow nets.

Energy equations: Bernoulli's equations and its applications in pitot static tube, venturimeter, and orifice meter, energy correction factor, Momentum equation, Applications of momentum equations in pipe bends, impact of jets on moving and stationary ,plane and curved vanes, moment of momentum equations, force exerted on a series of radial curved vanes .

Dimensional Analysis: Buckingham's theorem, Non-dimensional numbers, similarities of flow. Model studies.

Laminar and Turbulent Flows: Reynolds experiments. Shear stress and velocity distribution for viscous flow through circular pipes and flat plates, Hagen Poiseuille's equation, concept of boundary layer theory and separation of fluid flow, causes of turbulence, Characteristics of turbulent flow.

Flow through pipes: major and minor energy losses in pipes, pipes in series and parallel, equivalent pipes, cavitation , water hammer

Flow around immersed bodies: basic concept of lift and drag, coefficient of lift and drag.

Fluid Machinery: Pumps: Principles of operations and work done of centrifugal pumps, efficiencies , specific speed ,net positive suction head, problems, Principles and working of gear, vane and reciprocating pumps.

Turbines: classification, Principles of operations and work done Pelton, Francis and Kaplan, efficiencies, specific speed, no problems.

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References:

1. Streeter and Wiley , Fluid Mechanics,McGraw Hill Pub.1983
2. S.K.Som , G. Biswas, Introduction To Fluid Mechanics And Fluid Machines, Tata McGraw Hill 2004
3. A.K.Jain, Fluid Mechanics, Khanna Pub.
4. R.K.Bansal,Fluid mechanics and Machinery, Laxmi Publications. 2002
5. Domkundwar and Domkundwar, Fluid mechanics and Hydraulic Machines, Dhanpat Rai Pub.2006
6. R.K.Rajput , Atext Book Of Hydraulic Machines, S. Chand and Co. 2002

AUE 303 : **Engineering Thermodynamics**
Contacts : **3L + 1T**
Credit : **4**

Basic Concepts: Systems, Zeroth law, First law. Steady flow energy equation. Heat and work transfer in flow and non- flow processes. Second law, Kelvin Planks and Clausius statements. Concept of entropy, Clausius inequality, Entropy changes in non-flow processes.

Properties of gases and vapours : Rankine cycle, Air standard cycles - Otto, Diesel Dual combustion and Brayton cycles, Air standard efficiency, Mean effective pressure.

Reciprocating air compressors.

One dimensional fluid flow: Application of continuity and energy equations. Isentropic flow of ideal gases through nozzles. Simple jet propulsion system.

Refrigeration and Air-Conditioning: Principles of refrigeration, air-conditioning and heat pumps. Vapour compression and vapour absorption systems, co-efficient of performance. Properties of refrigerants.

Heat Transfer: Conduction in parallel, radial and composite wall, Convective heat transfer with laminar and turbulent flows, Overall heat transfer co-efficient. Flow through heat exchangers. Fundamentals of radiative heat transfer.

References:

1. Nag.P.K, Engineering Thermodynamics, Tata McGraw Hill Co Ltd., Seventh Edn, 1993.
2. Mayhew and Rogers, Engineering Thermodynamics, Longman Green & Co Ltd., London, E.L.B.S. Edn, 1990.
3. Van Wylen.G.J. and Sonntag. R.E., Fundamentals of Classical Thermodynamics (SI Version) 2nd Edn, 1986
4. D.H.Bacon, Engineering Thermodynamics, Butterworth & Co., London, 1989.
5. M.A.Sadd Thermodynamics for Engineers, Prentice Hall of India Pvt Ltd., 1989
6. Reynolds, Thermodynamics, Int. Student Edn, McGraw Hill Book Co Ltd., 1990.

AUE 304 : **Manufacturing Methods**
Contacts : **3L**
Credit : **3**

Introduction: Classification and Comparison of Manufacturing Processes, Criteria for selection of a Process.

Foundry: Materials used for Pattern making, Types of Patterns, Allowances, Core, Box, Core prints; Elements of Sand Mould Casting; Sand Properties and Types; Moulding Methods; Design of Patterns and Cores; Design of Gating Systems; Solidification of Castings; Design and Placement of Risers, Principle of Die casting. Centrifugal Casting, Investment Casting, Shell Moulding and CO₂ process, Casting Defects and Inspection of Casting.

Welding: Classification of Welding Processes; Arc Welding- Principle of Arc, Metal Transfer, Arc Characteristics; Working and applications of Carbon Arc Welding, Flux Shielded Metal Arc Welding (SMAW), TIG (GTAW), MIG (GMAW), SAW and ESW; Resistance Welding- Spot, Seam, Projection and Flash Butt; Gas Welding- Oxy Acetylene and Oxy Hydrogen; Thermit Welding; Solid State Welding Processes; Fusion Welding Pool and Welding Defects, Allied Processes- Brazing and Soldering.

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Conventional Machining: Constructional Details and Working of Lathe, Drilling Machine, Milling Machine, Shaper and Planer; Tooling, Attachments and Operations Performed, Process Geometry, Cutting Conditions, Calculation of Time of Machining (T_m) and Material Removal Rate (MRR), Cutting Tool Materials and Cutting Fluids.

Metal forming: Basic concepts and classification of forming processes, Principal equipment used and Application of Forging, Rolling, Extrusion, Wire drawing, Spinning.

Powder metallurgy: Principle, Process, Applications, Advantages and Disadvantages of Powder Metallurgy, Processes of Powder Making and Mechanisms of Sintering.

References:

1. Elements of Workshop Technology by Hajra Choudhury, Vol-I and Vol-II Media promoters pub. 2007
2. Production Technology by R.K.Jain and S.C.Gupta, Khanna Publishers.
3. H.M.T. Production Technology-Hand Book, Tata McGraw Hill. 1980
4. Workshop Technology by W.A.J. Chapman Part I, II & III. 1976, 1998
6. A text book of Production Engineering by Sharma P.C , S.Chand.2002
7. Manufacturing Technology - Foundry Forging & Welding by Rao P.N, Tata McGraw Hill. 1998

M 303 : **Mathematics**
Contacts : **3L + 1T**
Credit : **4**

Series Solution of Ordinary Differential Equation (ODE): Special Functions: Introduction, validity of series solution of an ordinary differential equation, general method to solve equation of the type: $P_0y'' + P_1y' + P_2y = 0$; problems; Bessel's equation; properties of Bessel's function; Recurrence formula for Bessel's function of first kind ($J_n(x)$); Equation reducible to Bessel's equation; Legendre's equation, Legendre function;

Recurrence formula for Legendre function ($P_n(x)$); Orthogonality relation.

Calculus of Complex Variable: Functions, Limits and Continuity, Analytic Functions, Cauchy Riemann Conditions, Analytic Continuation, Complex Integration and Cauchy's Theorem, Cauchy's Integral Formula, Taylor's and Laurent Series, Zeros of an Analytic Function; Poles, Essential Singularities, Residue Theorem and its application to evaluation of integral, Introduction to Conformal Mapping, Simple problems.

Partial Differential Equations (PDE) and its Applications: Introduction, linear and nonlinear equation of first order; examples; homogeneous linear equations with constant coefficients and variable coefficient of second order, Separation of variables, Formulation and solution of wave equation; one dimensional heat flow equation and solution; two dimensional heat flow equation and solution.

Linear Programming Problem (L.P.P): Mathematical Formulation, Graphical Solution and Simplex Method, Charnes Big-M Method, Transportation Problems, Assignment Problems (Hungarian Method).

Reference:

1. Higher Engineering Mathematics by Dr. B. S. Grewal Khanna Pub. 2000
2. Linear Programming & Game Theory by Chakraborty & Ghosh, Montek Library, Kolkata 2003
3. Complex Variables by M. R. Spiegel M G H Singapore 1981
4. Partial Differential Equation by K. S. Rao P H Pub. 1995
5. Engineering Mathematics, Arumugam, Scitech Pub.1999

AUE 391 : **Strength of Materials Laboratory**
Contacts : **3P**
Credit : **2**

Simple Stress in Machine Parts : Different types of loads, stress and strain, working stress, factor of safety, deflection analysis; Resilience.

Torsion and Bending Stress in Machine Members : Torsional Shear Stress, Bending Stress in straight and curved beams; Principle Stress in designing machine members; Theories of Failure under Static Loads.

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Tension Test: Stress-strain diagram, determination of yield strength, ultimate strength, modulus of elasticity, percentage elongation and percentage reduction in areas; **Compression Test :** Torsion Test.

Hardness Measurements: Brinell and Rockwell tests.

Impact tests: Charpy and Izod tests; Bending test: determination of bending stresses; **Fatigue Test.**

AUE 392 : Fluid Mechanics and Machinery Laboratory
Contacts : 3P
Credit : 2

Fluid flow measurements: Coefficient of discharge for venturimeter, orificemeter, nozzle meter, weirs.

Flow through pipes: Pipe friction in laminar and turbulent flow regimes. Pitot tube experiments on viscous flow and boundary layer theory.

Experiment on fluid machinery: Pumps, jet pumps, blowers, and compressors.

AUE 394 : Manufacturing Process Laboratory -I

Contacts : 3P

Credit : 2

Pattern making; pattern material, pattern allowances and types of patterns.

Introduction to primary technology processes involving casting, preparation of foundry sand and molds, Experiments on properties of post casting, fettling, cleaning, deburring, polishing and painting operations.

Mould making Practice: Uses of moulding tools: green sand moulding, gating system, risering system, core making.

Casting: sand preparation, sand testing: specimen preparation, permeability, clay content, grain fineness number, green compression strength, green shear strength, dry strength, hardness. Characterisation of materials - solids and fluids.

Study of cupola.

AUE 395 : Graphics Laboratory-I

Contacts : 3P

Credit : 2

Application software: AutoCAD or similar drafting software

Computer Aided Drafting – introduction

Learning standard tools of Computer Aided Drafting with exercise

Creating 2D drawings of simple automotive component like gaskets, brackets, valves etc.

Applying dimension and tolerance on entities.

Creating 2D detail drawing, cross sections & partial views of automotive components like flywheel, piston etc.

Concept of multi layer system with exercise.

Applying geometrical tolerance on drawing.

References:

1. Shrock Cheryl R., Exercise Workbook for Beginning AutoCAD, New Age International, 2006.
2. George Omura, Mastering AutoCAD, BPB Publication, 2005.

SEMESTER – IV

AUE 401 : Engineering Analysis & Numerical Methods
Contacts : 3L
Credit : 3

Solution of equations and eigen value problems: Iterative method, Newton-Raphson method for single variable and for simultaneous equations with two variables. Solutions of linear system by Gaussian, Gauss-Jordan, Jacobi and Gauss-Seidel methods. Inverse of a matrix by Gauss- Jordan method, Eigen value of a matrix by power and Jacobi methods.

Interpolation: Newton's divided difference formula, Lagrange and Hermit's polynomials. Newton forward and backward difference formulae, Stirling's and Bessel's central difference formulae.

Numerical Differentiation and Integration: Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal and Simpson's rules. Two and three point Gaussian quadrature formula. Double integrals using Trapezoidal and Simpson's rules.

Initial value problems for ordinary differential equations: Single Step Methods-Taylor Series, Euler and Modified Euler, Runge-Kutta method of order four for first and second order differential equations.

Boundary value problems for ordinary and partial differential equations: Finite difference solution for the second order ordinary differential equations. Finite difference solution for one-dimensional heat equation one-dimensional wave equation and two-dimensional Laplace and Poisson equations.

References:

1. Sastry, S.S Introductory Methods of Numerical Analysis (Third Edition), Prentice Hall of India, New Delhi, 1998.
2. Kandasamy, P., Thilakavathy, K, and Gunnavathy, K, Numerical Methods, S.Chand & Co., New Delhi, 1999.
3. Grewal, B.S and Grewal J.S.Numerical Methods in Engineering and Science, Hanna Publishers, New Delhi, 1999.
4. Jain, M.K., Iyengar, S.R.K and Jain, R.K.Numerical Methods for Engineering and Scientific Computation (Third Edition), New Age International (P) Ltd., New Delhi, 1995.
5. Gerald, C.F. and Wheatley, P.O.Applied Numerical Analysis (Fifth Edition), Addison-Wesley, Singapore, 1998.
- 6.Narayanan, S., Manickavachakam Pillai, K.and Ramanaiah, G.Advanced Mathematics for Engineering Students Volume-III,S Viswanathan Pvt.Ltd.1993.

AUE 402 : Heat Transfer and Combustion
Contacts : 3L
Credit : 3

Conduction: Fourier law of heat conduction for isotropic material. Thermal conductivity. Derivation of the energy equation in three dimensions including transient effect. Nondimensional-thermal diffusivity and Fourier number. Types of boundary conditions- (Dirchlet, Neumann, mixed type). One-dimensional solution with and without heat generation. Analogy with electrical circuits.

Fins: rectangular and pin fins. Fin effectiveness and efficiency. Critical thickness of insulation.

Radiation: Physical mechanism of thermal radiation, laws of radiation, definition of black body emissive power, intensity of the radiation, emissivity, reflectivity, transmittivity, irradiation, radiosity. Radiation exchange between black bodies. Concept of Gray-Diffuse Isotropic (GDI) surface. Radiation exchange between GDI surfaces.

Convection: Introduction, Newton's law of cooling and significance of the heat transfer co-efficient. Momentum and energy equations in two dimensions, nondimensionalisation, importance of nondimensional quantities and their physical significance. Order of magnitude analysis for flow over a flat plate. Velocity and Analogies between momentum, heat and mass transfer. Natural convection.

Heat exchangers: Types of heat exchangers, parallel and counter flow types, Introductions to LMTD. Correction factors, fouling factor.

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Combustion Analysis: Fuels, HIV and LTV, Air requirements, excess air, analysis of products of combustion. Enthalpy of formation, adiabatic flame temperature, enthalpy of combustion, heat of reaction. Analysis of fuels and fuel gas. Orsats apparatus.

References:

1. Fundamentals of Heat and Mass Transfer by F.P.Incropera and D.P.Dewitt, 4th ed., John Wiley & Sons. 2002
2. Heat Transfer by J.P.Holman, 8th ed., McGrawhill.2002
3. Elements of Heat & Mass Transfer by Vijay Gupta, 2nd ed., New Age International Publishers. 1995
4. Heat Transfer - A Basic Approach by M.N.Ozisik, McGrawhill. 1985

AUE 403 : **Automotive Petrol Engines**
Contacts : **3L**
Credit : **3**

Engine Construction and Operation: Constructional details of 4stroke and 2 stroke petrol engine. Comparison of four stroke and two stroke engine operation. Firing order and its significance.

Working principle: Otto cycle, actual and real engine cycles.

SI Engine Fuel System: Carburettor and its working principle. Requirements of an automotive carburettor; Starting, idling, acceleration circuits of carburettors. Mechanical and Electrical pumps, fuel feed system.

Spark Ignition System: Magneto and Battery ignition systems for S.I. Engines; Ignition timing.

Combustion in SI engines: Stages of combustion, flame propagation, rate of pressure rise.

Abnormal combustion: Phenomena of knocking. Effect of engine variables on knock.

Combustion Chambers: Combustion chambers- Different types, Factor controlling combustion chamber design.

Petrol Injection strategies: M.P.F.I. and Port fuelling techniques.

Cooling System: Need for cooling system. Types of cooling system, Liquid and air cooled systems. Thermo syphone and pressurised cooling system. Properties of coolants.

Lubrication System :Lubrication system, Mist lubrication system, Wet sump and dry sump lubrication Forced feed lubrication system.

Scavenging Scavenging methods Scavenging pumps, Scavenging pumps

Testing Performance test of 2-stroke and 4- stroke petrol engine. I.H.P , B.H.P Mechanical efficiency, Brake thermal efficiency . Performance curve i.e. Load v.s. efficiency, Speed v.s. efficiency etc.

References :

1. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill Co., 2004.
2. K.K. Ramalingam, "Automobile Engineering", Scitech Publications Pvt. Ltd., 2005

AUE 404 : **Theory of Machines**
Contacts : **3L**
Credit : **3**

Introductions: Mechanisms and machines, Kinematics and kinetics;

Kinematics Fundamentals: degrees of freedom, types of motion , elements of kinematic chain, determination of degrees of freedom, paradoxes, isomers, linkage transformation, intermittent motion mechanism, inversion, Grashof's Criterion, *straight line generating mechanisms:* Pantograph, Paucellier mechanism;

Position, Velocity, Acceleration analysis: *graphical solution:* position of any point on linkage, Transmission angles, velocity by velocity polygon and Instantaneous centre method, acceleration; Coriolis component.

Analytical solution for fourbar, slidercrank mechanism. Freudenstein's equation, velocity of slip.

Computer aided analysis of position, velocity and acceleration.

Kinematic Synthesis of mechanisms: Functioning and path generation, Chebyshev spacing of precision points, *three position synthesis:* analytical method for fourbar , slidercrank mechanism.

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Cam profile analysis: motions of the followers, Cam profile constructions, analysis of cams with specified contours.

Kinematic analysis of gears: nomenclature and classification, law of gearing, path of contact, arc of contact, interference for spur gears.

Gear trains: simple, compound, reverted, *epicyclic gear trains:* compound epicyclic, epicyclic with bevel gears, sun and planet gear.

References:

1. Theory of Machines and Mechanisms by J.J.Shigley and J.J.Uicker, McGrawhill.1995
2. Theory of Machines by S.S.Rattan, TMH.1993
3. Design of machinery by R.L.Norton, McGrawhill
4. Theory of Machines by R.K.Bansal, Laxmi Publications
5. Mechanism and Machine Theory by J.S.Rao and R.V.Dukkipati, New Age International.1992

AUE 405 : **Design of Machine Elements**
Contacts : **3L**
Credit : **3**

Introduction: Definition, General procedures and considerations in Machine Design.

Limits, Fits and Tolerances: Indian Standard System for Limits and Fits, Preferred Numbers, Fundamental Deviation for Holes and Shafts

Fasteners and Fastenings: Cotter and Knuckle- Types of Cotter joints, Design of Socket and Spigot Cotter joint, Sleeve and Cotter joint, Gib and Cotter joint; Design of Knuckle joint; Screwed joints- Different forms and Dimensions of Screw threads, Advantages, Disadvantages, Screw Fastening, Stresses in Screwed Fastening; Rivets and Welded joints- Types of Riveted joints, Design of Riveted joints, Welding processes, Types of Weld joints, Strength of different Fillet weld joints and butt joints, Stresses for different Welded joints.

Shafts, Keys and Couplings: Design of shafts on the basis of Strength, Design of shafts on the basis of Rigidity, Types of keys, Design of Sunk keys, Effect of keyways, Types of Shaft Couplings, Design of Muff, Split muff and Flange Coupling.

Common Power and Force Transmitting Power Screws: Torque required to raise and lower load by square threaded screws, Efficiency, Maximum efficiency of square threaded screws, Overhauling and Self-locking screws, Design of Screw Jack.

Design of Belt Drives: Selection of Belt Drives, Types of Belt Drives, Materials of Belts, Belt joints, Types of Flat Belt Drives, Design of Flat Belt Drives.

Design of Springs: Helical compression, Tension springs under static and variable loads, Laminated springs.

References:

1. Mechanical Engineering Design by J.F.Shigley, McGrawhill.2003
2. Design of Machine Elements by M.F.Spotts, Prentice Hall.1998
3. Mechanical Analysis and Design by A.H.Burr and J.B.Cheathak, 2nd ed., Prentice Hall.1995
4. Fundamentals of Machine Elements - Hawrock, Jacobson - McGraw Hill
5. Design of machine elements by V. B. Bhandari, Tata McGraw Hill Pub.1994
6. A Text Book of Machine Design by R.S.Khurmi and J.K.Gupta, S.Chand Pub.2005

AUE406 : **Measurement and Instrumentation**
Contacts : **3L**
Credit : **3**

Basic concepts: Definition of terms, calibration, standards, generalized measurement systems, static and dynamic performance characteristic; Analysis of experimental data; Instrumentation for measurement of position and displacement, force, temperature, proximity and range. Concept of feedback; Open and close loop control systems, transducers and devices for engineering applications, digital readouts, data acquisition and processing.

B.Tech(Automobile Engineering) Revised Syllabus'2008

Metrology: Introduction, Measuring instruments, Measuring range, Sensitivity, Repeatability, Precision and Accuracy.

Standards : Definitions of line standard, end standard and wavelength standard, Sub divisions of standards. Slip gauges.

Measurement of angles : Introduction, Bevel vernier protractor, Sine bar, Angel gauges, Spirit level, Autocollimator, Angle dekkor, Rotary tables, Precision polygon, Calibration of polygons.

Measurement of internal and external tapers.

Measurement of threads : Introduction, Screw thread terminology, Pitch error, Angle error, Measurement of major and minor diameter, Measurement of effective diameter by one wire, two wire and three wire method. Best size wire.

Measurement of surface finish : Introduction, Surface texture, Surface roughness terminologies, Methods of measuring surface finish, Stylus probe instruments, Taylor-Hobson talysurf, Sample length or cutoff length, Analysis of surface traces.

Gear Measurements : Introduction, Terminology of gear tooth, Errors in manufacturing gears, Rolling test, Measurement of tooth thickness, Parkinson gear tester.

Inspection of straightness, flatness, and alignment.

Interferometry and use of optical flats.

Measurement of coordinates using Coordinate Measuring Machine.

References:

1. Mechanical measurements by T. G. Beckwith, N. L. Buck and R. D. Marangoni, 3rd ed, Narosa Publishing House.1993
2. Engineering Metrology by R. K. Jain Khanna Pub. 2002
3. A Text Book of Engineering Metrology by I. C. Gupta Dhanpat Rai and Co. 1998
4. Fundamentals of Dimensional Metrology by C. Dotson, R. Harlow and R. Thomson. Pub. 2003
5. Instrumentation, Measurement and Analysis by B. C. Nakra and K. K. Chaudhari, TMH, 1985
6. Measurement System- Application and Design by E. O. Doebelin, 4th ed, TMH, 1990

AUE 492 : Thermal Engineering Laboratory

Contacts : 3P

Credit : 2

Experiments on heat transfer: thermal conductivity of solids, liquids and gases, natural and forced convection, Experiments on emissivity and absorvity;

Heat exchangers: LMTD methods, mass transfer.

AUE 496 : Measurement and Instrumentation Lab.

Contacts : 3P

Credit : 2

Lab experiments involving: Measurements of position, displacement, velocity, force, temperature, proximity/range.

Measurements of various product features using mechanical, pneumatic, optical and electronic instruments, interferometer, surface roughness measurements, measurements of threads and gears.

Laboratory experiments and exercises involving hardware and software modular based off-line and on-line product gauging and inspection, information recording and processing etc.

AUE 497 : Manufacturing Process Laboratory - II

Contacts : 3P

Credit : 2

Surface preparation and etching techniques, heat treatment and metallographic studies.

Laboratory experiments in fabrication processes: Spot, MIG, ARC and Gas Welding, Testing of Joints.

Basic Forging processes like upsetting, drawing down and forge welding

B.Tech(Automobile Engineering) Revised Syllabus'2008

AUE 498 : **Graphics Laboratory – II**
Contacts : **3P**
Credit : **2**

Application software: AutoCAD or similar drafting software

Drafting exercises involving preparation of detailed drawings of automotive mechanical components like Crankshaft, Connecting rod etc.

Drafting exercises involving preparation of detailed drawings of automotive sheet metal and plastic components like Bonnet, Trunk lid, Door Handles etc.

Exercise of assembly drawing like connecting rod assembly, piston assembly etc using layers.

Layout – concept, application, importance in automotive design. Exercise on layout.

3D (solid/surface) model - concept with exercise.

References:

1. Shrock Cheryl R., Exercise Workbook for Advanced AutoCAD, New Age International, 2006
2. George Omura, Mastering AutoCAD, BPB Publication, 2005

HU 481 : **Technical Report Writing & / Language Practice Laboratory**
Contacts : **3S**
Credit : **2**

Topics to be covered and number of hours required for it:

Introductory lecture is to be given to the students so that they get a clear idea of the syllabus and understand the need for having such a practice lab in the first place(3 hours).

Conversation practice is done on given situation topics. The students are also made to listen to pre-recorded cassettes produced by British Council and also by the Universities of Oxford and Cambridge (6 hours)

Group Discussions:- The students are made to understand the difference between the language of conversation and group discussion. Strategies of such discussions are to be taught to them. It is also helpful to use videocassettes produced by the U.G.C. on topics like group-discussion. Afterwards the class is divided into groups and the students have to discuss on given topics on current socio-economic-political-educational importance (12 hours)

Interview sessions: students are taught the do's and don'ts of facing a successful interview. They then have to face rigorous practices of mock-interviews. There would be simulations of real life interview sessions where students have to face an interview panel (12 hours)

Presentations: The secrets of an effective presentation are taught to the students. Then each and every student has to make lab presentations with the help of the overhead projector/ using power point presentation and other audio-visual aids in the laboratory. They also have to face the question answer sessions at the end of their presentation (12 hours) Classes are also allotted to prepare the students for competitive examinations like the TOEFL by making the students listen to specially produced CD/ cassettes of such examinations (3 hours).

The overall aim of this course is to inculcate a sense of confidence in the students and help them to become good communicators in their social as well as professional lives.

References:

1. Business Correspondence & Report Writing by R.C. Sharma and K.Mohan, TMH1994
2. How to prepare for Group Discussion & Interview (With Audio Cassette) by Prasad, TMH, 2001
3. Spoken English – A self-learning guide to conversation practice (with Cassette) by Sasikumar, TMH, 1993

SEMESTER – V

AUE 501 : **Design of Mechanical Systems**
Contacts : **3L +1T**
Credit : **3**

Design of Variable Loads : Endurance limit, Goodman and Soderberg Criteria, Design of Shaft.
Design of clutches and brakes : Calculation of heat generation and heat dissipation; **Design of Gears**: Design of spur, helical, bevel and worm gears from strength and wear considerations;
Bearings : lubrication, selection procedure of antifriction bearings, journal bearings, hydrodynamic theory, design factors, the relation of the variables, heat balance, hydrostatic bearings.
Design of I.C. Engine parts: Piston, Piston skirt, Piston pin, Connecting rod, Flywheel.

References:

1. Computer Aided Mechanical Design and Analysis by V.Ramamurhti, 3rd ed., TMH.
2. Mechanical Analysis and Design by A.H.Burr and J.B.Cheatham, 2nd ed., Prentice Hall, 1995.
3. Mechanical Engineering Design by J.E.Shigley, McGraw Hill, 2003

AUE 502 : **Automotive Diesel Engines**
Contacts : **3L**
Credit : **3**

Engine construction_ Construction of 2- stroke and 4 - stroke diesel engine
Working principle_ Diesel cycle actual and real cycle., dual fuel cycle, comparison Otto, Diesel and Dual fuel cycles.
Diesel fuel:Ignition quality. Cetane number, Stoichometric, equation of combustion of diesel fuel.
Diesel Engine Combustion Concepts: Stages, heat release and ignition delay correlations. Abnormal combustion, factors affecting abnormal combustion. Knock in CI engines-comparison of knock in CI & SI engines
Fuel air mixing: Importance of air motion-swirl, squish and turbulence-swirl ratio.
period, factors affecting delay period.
Combustion Chambers- combustion chamber design objectives. Different types of combustion chamber. Direct and indirect injection chambers.
Fuel Injection System: Requirements, function of components, Jerk and distributor type Pumps. Fuel injector-types of injection nozzle, Spray characteristics, injection Timing.
Supercharging and Turbo Charging: Necessity and limitation, Charge cooling, Type of supercharging and turbo charging, Relative merits, matching of turbocharger.
Testing : Performance testing of 2-stroke and 4-stroke diesel engine I.H.P., B.H.P., Mechanical efficiency, Brake thermal Efficiency, Heat balance chart, Performance curve Variables effecting engine performance

References :

1. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill Co., 2004.
2. K.K. Ramalingam, "Automobile Engineering", Scitech Publications Pvt. Ltd., 2005

AUE 503 : **Material Science and Metallurgy**
Contacts : **4L**
Credit : **4**

Introduction to material science and metallurgy : classification and properties of engineering materials.
Selection of engineering materials : factors affecting the selection, systematic material selection methods and applications of different ferrous; non-ferrous and non metallic engineering materials.
Characteristics of materials: Elasticity, Stress and strain relationship in engineering materials, Deformation mechanism, strengthening of material such as strain hardening, alloying, polyphase mixture, martensitic, precipitation, dispersion, fibre and texture strengthening. Mechanical properties and

B.Tech(Automobile Engineering) Revised Syllabus'2008

technological properties like castability, machinability, formability, and weldability of metallic materials such as steel, cast iron, brass, bronze, and aluminum alloys.

Failure of materials: Fracture, Fatigue and Creep - classification and types, mechanism of initiation and growth, factors affecting fracture, fatigue and creep.

Solidification of metal, solid solutions, phase diagram, Iron Carbon equilibrium diagram, TTT diagram, effect of alloying element on steel,

Heat treatment and surface treatment: classification, purpose, and process of volume and surface heat treatment techniques for steel. Annealing, Normalizing, Hardening, Tempering, carburizing, Nitriding, Induction and flame hardening, etc with specific relevance to automotive components. Surface treatments such as coating and corrosion resistance, electroplating, phosphating, anodizing, hot dipping, thermal spraying, hard facing and thin film coating.

Criteria for selecting materials for automotive components viz. Cylinder Block, Cylinder Head, Piston, Piston Ring, Gudgeon pin, Connecting Rod, Crank Shaft, Cam Shaft, Cam, Engine Valve, Gear, Crown wheel and pinion, Clutch plate, Axle shaft, Chassis, spring, body panel, Brake lining etc.

Advance materials for automotive components: Characteristics, advantage/ disadvantages, and applications.

Reference :

- 1) Materials science and Engineering: An Introduction – W.D. Callister, Jr. 2004
- 2) Physical Metallurgy-Vijendra Singh, St.Publ, New Delhi, 1999.
- 3) Mechanical Metallurgy-Dieter, G. E, McGraw Hill, 1988
- 4) Physical Metallurgy- Raghavan, V, Publ, New Delhi, PHI, 1983
- 5) Fundamentals of Material Science and Engineering, W .F .Smith, McGraw Hill, 1983

AUE 504 : Power unit and Transmission
Contact : 4L
Credit : 4

Transmission Layout of power transmission system, requirement of transmission system

Clutch Need of clutch. Types of clutches, principle, construction , torque capacity, clutch operating system. performance curve.

Gear Box Requirement of gearbox, different types of gear box viz sliding ,constant mesh and synchromesh gear box. Construction details of gear boxes. Gear ratios of vehicle Gear box operation principle.

Hydro dynamic drive. Fluid coupling, Principle and operation Torque capacity Performance characteristic.

Torque converter Construction, principle of operation, Torque capacity multistage torque converter Performance behaviour.

Automatic transmission Construction and operating principle, 4 forward and reverse & 3 forward and reverse. Over drive unit and its operation

Hydro static drive : Construction and operation

Electric drive Ward Leonard control system , construction and operation, advantages and disadvantages

References :

1. Crouse Wand Anglin D, Automotive Mechanics, Tata Mcgraw hill PublicationLtd 10th edition 2004
2. Nakra C P , Basic automobile Engineering, Dhanpat Rai Publication co. Ltd 7th edition 2005
3. De A Automobile Engineering, Galgotia Publication Pvt. Ltd. 2004
4. Josepe Heitner Automotive Mechanics – Principle and Practice, East West Press 2nd edition 1999

AUE 505 : Automotive Chassis
Contacts : 3L
Credit : 3

Introduction: Types of chassis layout with reference to power plant locations and drive. Vehicle frames. Various types of frames.

B.Tech(Automobile Engineering) Revised Syllabus'2008

Constructional details. Materials. Testing of vehicles frames. Unitised frame body construction, Loads acting on vehicle frame.

Front axle and Steering System: Types of front axle. Constructions details. Materials. Front wheel geometry viz. Castor, Camber, King pin inclination, Toe-in. Conditions for true rolling motion of wheels during steering. Steering geometry. Ackerman and Davis steering system. Constructional details of steering linkages. Different types of steering gear boxes. Steering linkages and layouts. Power and Power assisted Steering.

Drive Line: Effect of driving thrust and torque reactions. Hotch Kiss drive, torque tube drive and radius rods. Propeller shaft. Universal joints. Constants velocity universal joints. Front wheel drive.

Final Drive Differential: Different types of final drive. Worm and worm wheel, Straight bevel gear, Spirial bevel gear and hypoid gear final drives.. Differential principles. Construction details of differential unit. Differential locks. Differential housings.

Rear Axles: Construction of rear axles. Types of loads acting on rear axles. Full floating. Three quarter floating and semi floating rear axles. Rear axle housing. Construction of different types of axle housings

Suspension System: Need of suspension system, types of suspension, suspension springs, constructional details and characteristics of leaf, coil and torsion bar springs. Independent suspension, Rubber suspension, Pneumatic suspension, Shock absorbers.

Braking System: Classification of brakes, drum brake & disc brakes. Constructional details-Theory of braking. Mechanical hydraulic and Pneumatic brakes. Servo brake. Power and power assisted brakes- different types of retarders like eddy current and hydraulic retarder. Anti lock braking systems.

References:

1. Jack E Rjavee Automotive Technology- A system approach, Thomson Asia Pte Ltd. Singapore, 3rd edition 2004
2. De A Automobile Engineering, Galgotia Publishers Pvt Ltd , 2004
3. Ramalingam K K Scitech Publication (India) Pvt. Ltd. 2nd edition 2004
4. Joseph Heitner, Automotive Mechanics Principle and Practice East west press, 2nd edition 1999

AUE 591 : **Design Practice**
Contacts : **3P**
Credit : **2**

Drawing board exercises compatible to the course AUE 405 (Design of Machine Elements) and AUE 501 (Design of Mechanical Systems).

AUE 594 : **Engine Components Laboratory**
Contacts : **3P**
Credit : **2**

Study of various makes of four-stroke and two-stroke spark-ignition and compression ignition engines and components by dismantling and assembling various parts.
Comparison of engine components.

AUE 595 : **Chassis Components Laboratory**
Contacts : **3P**
Credit : **2**

Study and measurement of various makes of Automobile Chassis, such as Tata, Leyland, Ambassador etc.
Study, dismantling and Assembling of Front axle, Rear axle, Clutch, Gear box, Steering system, Braking system, Differential mechanism

B.Tech(Automobile Engineering) Revised Syllabus'2008

AUE 597	:	Manufacturing Process Laboratory - III
Contacts	:	3P
Credit	:	2

Laboratory exercises involving machining of complex product configurations, machining of spur and helical gears, relieving and profiling, contouring, finishing processes. Grinding of tools and cutters.

SEMESTER – VI

AUE 601	:	Automotive Electrical Systems and Electronics
Contacts	:	4L
Credit	:	4

Starting System: Condition at starting, Behavior of starter during starting, and its characteristics, Principle & construction of starter motor, working of different starter drive units, care and maintenance of starter motor. Starter Switches. Three point starter-basic construction and working principle.

D.C Machine: Main construction Features, Armature winding, Commutator, Basic principle of a d.c. generator, Slip-ring, commutation, Operating characteristic and application of D.C. generators. Armature reaction, Total loss in d.c. generator, Working principle of d.c. motor, Types of d.c. motor and it's characteristics, Speed control of D.C motor.

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

Automotive Electronics: Current trends in modern automobiles, Open and close loop systems-Components for electronic engine management, Electronic management of chassis system, Vehicle motion control.

Sensors and Actuators: Basic sensor arrangement, Types of sensors such as-Oxygen sensors, Crank angle position sensors-Fuel metering/vehicle speed sensor and detonation sensor-Altitude sensor, flow sensor. Throttle position sensors. Solenoids, stepper motors, and relays.

Transducer: Introduction, Mechanical spring devices, Pressure sensing primary devices, Basic requirements of transducer, Classification of transducer, Resistive transducer, Capacitive Transducer, Strain gauges, Thermistors, Thermocouples, L.V.D.T, R.V.D.T, Magnetoresistors, Magnetostrictive Transducers, Photoelectric transducer, Digital displacement transducer.

Electronic Fuel Injection and Ignition Systems: Introduction, feed back carburetor systems. Throttle body injection and multi port or point fuel injection., fuel injection systems, Injection system controls. Advantages of electronic ignition systems: Types of solid-state ignition systems and their principle of operation, Contact less electronic ignition system, and electronic spark timing control.

Digital Engine Control System: Open loop and closed loop control systems-Engine cranking and warm up control-Acceleration enrichment-Deceleration leaning and idle speed control. Distributor less ignition-Integrated engine control systems, Exhaust emission control engineering.

Electronic Dashboard Instruments : Onboard diagnosis system, security and warning system.

References:

1. Judge. A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992.
2. Young. A.P., & Griffiths. L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990.
3. Vinal. G.W. , Storage Batteries, John Wiley & Sons Inc., New York, 1985.
4. Crouse. W.H. , Automobile Electrical Equipment, McGraw Hill Book Co Inc., New York, 1980
5. Spreadbury. F.G. Electrical ignition Equipment, Constable & Co. Ltd., London 1962.
6. Kholi. P.L., Automotive Electrical Equipment, Tata McGraw-Hill Co. Ltd. New Delhi, 1975.
7. Automotive Hand Book, Robert Bosch, Bentley Publishers, 1997.

B.Tech(Automobile Engineering) Revised Syllabus'2008

8. William B. Ribbens, Understanding Automotive Electronics, 5th Edition, Butterworth, Heinemann Woburn, 1998.
- 9 Tom Weather Jr and Cland C. Hunter, Automotive Computers and Control System, Prentice Hall Inc., New Jersey.
10. Young. A.P. and Griffiths. L. Automobile Electrical Equipment, English Language Book Society and New Press.
11. Crouse. W.H., Automobile Electrical equipment, McGraw Hill Book Inc., New York,1955.
12. Robert N Brady Automotive Computers and digital Instrumentation reston Book, Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
13. Bechtold, Understanding Automotive electronics, SAE, 1998.
14. T.Mellard Automotive Electronics.
15. J.B. Gupta, Electrical Machines,S.K Kataria & Sons Publishers.
16. J.B. Gupta, Electronics and Electrical Measurements and Instrumentation,S.K. Kataria & Sons Publishers.

AUE 602 : **Vehicle Body Engineering**
Contacts : **3L**
Credit : **3**

Car body details Saloon car, Hatch back car, convertible, limousine Estate van, racing car and sports car.

Bus body details Single decker and double decker bus, Mini bus, Bus body layout. Floor height, Engine location, Entrance and exit position Seat and other commercial vehicle dimension

Aerodynamic effect : Pressure distribution on vehicle surface. Air resistance on vehicle, Wind tunnel testing. Flow visualization around vehicle. Methods of reducing air resistance . Effect of side force and wind thrust.

Resistance to motion Tractive effort, Gradient resistance, rolling resistance. total resistance. Tractive effort V.S. speed and performance curve. Power calculation for vehicle, Drawbar pull

Body : Body design requirement, car body space nomenclature. Body frame of passenger car and commercial vehicle. Different type of car door and window regulator, car roof, wind shield, car seats and their various design.

Safety aspect : Driver's safety, use of air bag and their details

Body materials : Different types of ferrous and non-ferrous materials used in vehicle such as cast iron. Steel. Alloy steel, plastic, G.R.P.Glass etc. and their properties

Painting : Corrosion and anticorrosion method .Paint and painting process

References :

1. Crouse W and Anglin D, Automotive Mechanics Tata Mcgraw hill publication 10th edition, 2004
2. Jack E Rjavee, Automotive Technology- A system approach, Thomson Asia Pte Ltd, Singapore, 3rd edition, 2004
3. K Sing Automobile Engineering vol-I Standard Publishers Distributor 2003

AUE 603 : **Two and Three Wheelers**
Contacts : **3L**
Credit : **3P**

Power Unit: 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.

Chassis and Sub-Systems: Mainframe, 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.

Brake and Wheels: Drum brakes, Disc brakes, front and rear brake links layouts. Spoked wheel, Cast wheel. Disc wheel. Disc types. Tyres & tubes.

Two wheeler dynamics: Stability of two wheelers on straight and curved path.

B.Tech(Automobile Engineering) Revised Syllabus'2008

Two Wheelers: Case study of major Indian models of motorcycles, SCOOTERS AND MOPEDS. Bajaj, Vespa, Lambretta scooters. Enfield, TVS-Suzuki, Hero-Honda, Yamaha RX-100, Kawasaki Bajaj Motor cycle. Kinetic Spark, Hero Majestic, TVS mopeds. Servicing and maintenance.

Three Wheelers: Case study of Indian Models. Front engine and rear engine. Auto rickshaws. Pickup van. Delivery Van and Trailer, stability of three wheelers.

References:

1. Gupta H M Automobile Engineering vol I & II 1st edition Reprint 2006
2. Gupta R B Automobile Engineering , Satya Prakashan 2004
3. Banga T B nad Sing N Khanna Publication 2001
4. Narang G B S Khanna Publication 5th edition 10th reprint 2003

AUE 604 : **Automotive Pollution and Control**

Contacts : **4L**

Credit : **4P**

Introduction: General Scenario on automotive Pollution, Pollutants-sources-formation-effects-transient operational effects on pollution.

Engine Combustion and Pollutant Formation: HC, CO, NO_x, Particulate Matters, Aldehyde emissions, Effect of operating variables on emission formation.

Emission Control Efforts: Supply of fuel – establishment of national test centers, construction of road networks.

Alternate Fuels : Estimation of petroleum reserve – need for alternate fuels – Merits & Demerits and uses of CNG, LPG, Alcohols, Hydrogen, Bio-fuels, Electric Energy, Solar Energy.

Emission Standards : Evaluation of Emission Standards – Mandatory Tests for Emission measurement – Type Approval & Production Conformity Tests – Driving Cycles, Bharat Stages & Euro emission standards.

Control Techniques for SI and CI: Design changes, optimization of operating factors, Control of Crankcase emission, Evaporative emission, Exhaust emission - exhaust gas recirculation, air injector PCV system, thermal reactors, catalytic converters.

Test Procedure & Instrumentation for Emission Measurement: Test procedures- Measurements of invisible emissions -ORSAT apparatus, NDIR analyzer, Flame ionization detectors, Chemiluminescent analyzer, Gas analyzer, Measurements of visible emissions – Comparison methods & Obscure methods - Smoke meters, Emission standards.

Reference:

1. B.P. Pundir, “Engine Emissions”, Narosa Publishing House, 2007.
2. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill Co., 2004.
3. K.K. Ramalingam, “Automobile Engineering”, Scitech Publications Pvt. Ltd., 2005
4. Amitosh De, “Automobile Engineering”, Galgotia Publications Pvt. Ltd., 2004
5. Dr. N.K. Giri, “Automobile Mechanic”, Khanna Publishers, 2006
6. Heywood. J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co., 1995.
7. Automobiles and Pollution SAE Transaction, 1995.

AUE605 : **Quality Control and Reliability Engineering**

Contacts : **3L**

Credit : **4**

Quality concepts: Quality factors influencing quality, Dimensions of quality, Quality costs, Quality assurance, Quality planning, Organization for quality, Bureau of Indian standards, ISO 9000, Quality circles, KAIZEN-TQM concepts, Quality audit.

Statistical process control: Statistical tools used in quality in SQC, Variation in processes, Control charts, Variables, Attributes, Establishing and interpreting control charts, \bar{X} , R chart, p chart, c chart, u chart. Process capability, Analysis of process capability.

B.Tech(Automobile Engineering) Revised Syllabus'2008

Acceptance Sampling: Lot-by-lot sampling, types probability of acceptance in single, double, multiple sampling techniques, O.C curves, producers' risk and consumers' risk, AQL, LTPD, AOQL concepts, Standard sampling plans for AQL and LTPD-uses of standard sampling plans.

Life Testing-Reliability System Approach: Life testing-objectives-classification-failure characteristics-failure data analysis-mean time to failure-maintainability and availability-reliability-system reliability-series and parallel systems-system reliability in terms of probability of failure-MTBF-Acceptance sampling based on reliability test OC curves.

Quality and Reliability: Reliability improvement techniques, use of parato analysis- Design for reliability, Redundancy, standby redundancy, optimization in reliability, product design, product analysis, product development, product cycle.

References:

1. Fundamentals of Quality control and Improvement by Amitava Mitra. P H I, 1998
2. Statistical Quality Control by Grant, T M H , 1996.
3. Concepts in Reliability Engineering by L. S. Srinath, EWP.
4. Reliability for Technology, Engineering, and Management by Paul Kales, Prentice Hall, 1998

AUE 691 : **Automotive Electrical and Electronics Laboratory**
Contacts : **3P**
Credit : **2**

Study of rectifier and filters, Characteristics of amplifiers, Study of Logic Gates, Adder and Flip-Flops, Study of SCR and IC timer, D/A and A/D converter, Assembly language programming exercise, Interfacing A/D converter and simple data acquisition, Interfacing Stepper motor control and CRT terminal, Micro controller programming and interfacing, Study of battery charging system and setting of regulators and cutout.

AUE 694 : **Engine Testing and Pollution Measurement Laboratory**
Contacts : **3P**
Credit : **2**

Study of Pressure pickups, charge amplifier, storage oscilloscope and signal analysers used for IC engine testing.

Performance study of petrol and diesel engines both at full load and part load conditions.

Morse test on petrol and diesel engines.

Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in engines.

Heat balance test on an automotive engine.

Testing of 2 and 4 wheelers using chassis dynamometers.

Study of NDIR Gas Analyser and FID.

Study of Chemiluminescent NOx analyzer.

Measurement of HC, CO, CO₂, O₂ using exhaust gas analyzer.

Diesel smoke measurement.

References:

1. Giles. J.G., Vehicle Operation and performance, IIIiffe Books Ltd., London, 1989.
2. Crouse. W.H. and Anglin. D.L., Motor Vehicle Inspection, McGraw Hill Book Co., 1978.
3. Ganesan. V., Internal Combustion engines, Tata McGraw Hill Co., 1994.
4. BIS code Books, IS-10000 series, 1988.

AUE 696 : **CAD Application in Automotive Engineering - I**
Contacts : **3P**
Credit : **2**

Application software: CATIA, Pro/Engineer or similar 3D modeling software

3D modeling : introduction, approach, advantage.

Learning different tools of modeling software with exercise.

B.Tech(Automobile Engineering) Revised Syllabus'2008

Design, modeling and drawing of some automotive engine/mechanical components like

Inlet & exhaust valve, Piston, gudgeon pin, piston rings

Design, modeling and drawing of complete connecting rod including small end and big end, shank, end caps bolts.

Wire frame and Surface modeling:

Modeling of complicated shaped solid using surface modeling with exercise.

Surface modeling of exterior parts like bonnet, trunk lid etc.

References:

1. R.S.Khurmi, A Text Book of Machine Design, Eurasia, 2005.
2. Sham Tickoo, Catia for Engineers & Designers, Dreamtech, 2005.
3. Goutam Pohit & Goutam Ghosh, Machine Design with AutoCAD, Pearson Education, 2005.

AUE 697 : **Vehicle Maintenance Laboratory**
Contacts : **3P**
Credit : **2**

Study and layout of an automobile repair, service and maintenance shop.

Study and preparation of different statements/records required for the repair and maintenance works

Study and preparation of the list of different types of tools and instruments required

Minor and major tune up of gasoline and diesel engines Fault diagnosis in electrical ignition system gasoline fuel system, diesel fuel system and rectification

Study of faults in the electrical systems such as Head lights, Side of Parking lights, Trafficator lights, Electric horn system, Windscreen wiper system, Starter system and Charging system.

Study of fuel filters (both gasoline and diesel engines) and air cleaners (dry and wet)

Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.

Practice of the following:

Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play

Air bleeding from hydraulic brakes, air bleeding of diesel fuel system.

Wheel bearings tightening and adjustment.

Adjustment of head lights beam.

Removal and fitting of tire and tube.

References:

1. Automotive Trouble shooting and Maintenance by Anderson Ashburn.
2. Venk. Spicer, Automotive Maintenance and Trouble shooting.

SEMESTER – VII

AUE 701 : **Vehicle Dynamics**
Contacts : **3L**
Credit : **3**

Turning moment diagrams: coefficient of fluctuation of speed and energy, Flywheels.

Governors: centrifugal governors: Watt, Porter, Hartnell ; stability criterion, controlling force, and sensitiveness.

Balancing: Dynamics of Rotary and Reciprocating Mass.

Rotating mass: single rotating mass, balancing of several masses rotating in same plane

Reciprocating mass: Partial balancing of primary force and secondary balancing of multi cylinder inline engines.

B.Tech(Automobile Engineering) Revised Syllabus'2008

Vibrations: Introduction: Fundamentals of vibration, Free vibrations: Forced vibration : Damped and undamped, system analysis, Torsional vibration, Critical speed, Vibration isolation and vibration absorber, Vibration model for vehicle.

Gyroscope: Precisional motions and gyroscopic stability, gyroscopic couple, effect on stability of four wheelers, critical speed

Stability of vehicle :Analysis of stability when vehicle moving on plane road, inclined road, Traversely inclined road, curved and banked road.. Effect of centrifugal force and subsequent distribution of load.

Forces on suspension: Load on suspension in fore and aft direction. Load on suspension both for rigid suspension and independent suspension system. Effect of braking and accelerating on suspension, Conditions of maximum load on suspension, spring rate, Sprung mass and unsprung mass

Vehicle Handling: Slip angle, Over steer and under steer and its relation with slip angle. Steady state and transient cornering, Lateral force developed during cornering.. Cornering stiffness, Ackerman angle Effect of camber. Power consumed by tyre

Riding characteristic of tire: Effect of inflation pressure on tire, tire life, tire wear. Over loading and wrong loading Driving habit. Wheel wobble and its effect

Effect of braking : Braking torque requirement on surface of tire. Braking torque in side the drum brake and disc brake, Force analysis on master cylinder and wheel cylinder.

References :

1. Giri N K Automobile Mechanics, Khanna Publication 8th edition 2006
2. Giri N K Automotive Technology Khanna Publication 1st edition 2004
3. Gupta K M Automobile Engineering vol. I & II, Umesh Publication 1st edition Reprint 2006
4. Theory of Machines by S.S.Rattan, TMH 1993
5. Theory of Machines by R.K.Bansal , laxmi Publications
6. Mechanism and Machine Theory by J.S.Rao and R.V.Dukkipati, New Age International 1992

AUE 702 : Operations Research and Industrial Management
Contacts : 3L + 1T
Credit : 4

Operations Research: Introduction to OR, definition, linear programming; graphical method, simplex method, dual problem, transportation and assignment problems,

Project Management: CPM and PERT, Queuing theory, Game theory, Markov chain,

Industrial Management: Principles and functions of Management - Leadership and decision making,

Human resources: Personnel management - manpower planning, training and development, remuneration and incentive schemes; Industrial Legislation and Relations - health, safety, welfare; Industrial Psychology.

Materials, Purchase and Stores Management.

Sales and Marketing Management.

Cost Accounting and Control, Budget and Budgetary control.

References :

1. L.C. Jhamb and Savita Jhamb, "Industrial Management – I", Everest Publishing House, 2007
2. S.K. Sharma & Savita Sharma, "Industrial Engineering & Operation Management", S.K.Kataria & Sons, 2007-2008.
3. Operations Research - An Introduction by H.A.Taha, Prentice Hall of India, 2007
4. Operations Research by J.K.Sharma, Macmillan.
5. Introduction to management Science by Anderson, Sweeney and Williams, Thomson.

HU 701 : Ethics in Engineering Profession
Contacts : 3L
Credit : 3

Science, Technology and Engineering as knowledge and as social and professional activities.

B.Tech(Automobile Engineering) Revised Syllabus'2008

Inter-relationship of technology growth and social, economic and cultural growth; historical perspective. Ancient, medieval and modern technology/industrial revolution and its impact; the Indian Science and Technology.

Social and human critiques of technology; Mumford and Ellul.

Rapid technological growth and depletion of resources; reports of the club of Rome; limits to growth; sustainable development.

Energy crisis, renewable energy resources.

Environmental degradation and pollution; eco-friendly technologies; environmental regulations; environmental ethics.

Technology and the arms race; the nuclear threat.

Appropriate technology movement of Schumacher; later developments.

Technology and the developing nations; problems of technology transfer; technology assessment/impact analysis.

Human operator in engineering projects and industries; problems of man-machine interaction; impact of assembly line and automation; human centred technology.

Industrial hazards and safety; safety regulations, safety engineering.

Politics and technology; authoritarian versus democratic control of technology; social and ethical audit of industrial organizations.

Engineering profession; ethical issues in engineering practice; conflicts between business demands and professional ideals; social and ethical responsibilities of the engineer; codes of professional ethics; whistle blowing and beyond; case studies.

References :

1. Johnson, Deboarh G (Ed) : Ethical Issues in Engineering : Prentice Hall, New Jersey, 1991.
2. Unger, Stephen H : Controlling Technology : Ethics and The Responsible Engineer (Second Edition) : John Wiley & Sons, Inc. : New York, 1994.
3. Mumford, Lewis : Technics and Civilization : Routledge and Kegan Paul, London, 1934.
4. Ellul, Jacques : The Technological Society, Alfred A. Knof, New York, 1964
5. Tripathi, A.N. : Human Values (Second Edition) : New Age International (P) Ltd., New Delhi, Reprint 2005.
6. Vellasquez, Manuel G : Business Ethics : Concepts and Cases (Fifth Edition) : Santa Clara University, Third Indian Reprint 2004
7. Boatright, John R : Ethics and the Conduct of Business (Fourth Edition) : Loyola University, Chicago, Second Indian Reprint 2005.

HU 702 : **Engineering Economy and Financial Management**
Contacts : **3L**
Credit : **3**

Interaction between economic theory and production; concept of firm, industry and economy.

Consumer behavior, utility, indifference curves and maps; consumers' supply, demand function.

Production function, effect of technology, short and long ranges cost functions, monopoly and competition, determination of price, price discrimination, pricing of products.

Function of financial management and financial executive; nature of risk, interrelationship between risk and return; effect of tax on return.

Analysis and interpretation of standard financial statements.

Concept of operating cycle and working capital management.

Planning of profit and leverage (operating and financial).

Project evaluation indices like NPV, IRR.

Definition and scope of cost accountancy and costing methods; Elements of cost identifications; Recording, ascertainment of direct material and labour cost; Overhead classification, distribution and absorption; Process costing, uniform, marginal and standard costing methods; Case studies showing application of financial management and costing methods.

References:

1. Engineering Economics by E.Paul Degermo.
2. Engineering Economics by James L. Riggs.

B.Tech(Automobile Engineering) Revised Syllabus'2008

AUE 794 : **CAD Application for Automotive Engineering -II**
Contacts : **3P**
Credit : **2**

Application software: CATIA, Pro/Engineer or similar 3D modeling software.

Design, modeling and drawing of Fly wheel, Ring gear.

Design, modeling and drawing of Crankshaft, balancing weight calculation, front end and rear end details.

Design and drawing of Cam and Camshaft, Cam profile generation.

Assembly modeling of automotive mechanicals like:

Connecting Rod, Piston and its accessories.

Flywheel, Ring Gear and studs.

Overview of Finite Element Modeling and Analysis with exercise.

References:

1. R.S.Khurmi, A Text Book of Machine Design, Eurasia, 2005.
2. Sham Tickoo, Catia for Engineers & Designers, Dreamtech, 2005.
4. P.N.Rao, CAD/CAM principle and application, Tata McGraw Hill, 2004

AUE 795 : **Project**
Contacts : **9P**
Credit : **6**

Students will be exposed to lecture modules on project and thesis work followed by assignment of individual projects involving manufacturing/design Automobile components. An industrial project may also be undertaken by the student to be supervised jointly by industry personnel and the teacher.

Elective Papers I

AUE 711 : **Advanced Manufacturing Technology**
Contacts : **3L**
Credit : **3**

Integrated automation, computers and managerial challenges; modern cutting tools and tool management, CAPP, high speed machining, precision machining;

Non-traditional machining: EDM, ECM, USM, PAM, EBM, AJM, WJM, Explosive forming and LBM.

Graphics standards - CAD and CAE, Computer networking, GT concept, FMS, CIM, **Computer aided Quality Control**, CMM, Application of AI in CAD/CAM/CIM., Reverse Engineering, Rapid Prototyping and Tooling.

AUE 712 : **Theory And Design Of Jigs and Fixtures**
Contacts : **3L**
Credit : **3**

Introduction: 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 – Advantages of Jigs & Fixtures.

Location and Clamping: Degrees of freedom-3-2-1 location principle-Radial location and diamond pin location-Principle of pin location- Location from pin surfaces-location from a profile-location from a cylinder-Circular location-Jamming and remedies-V location-Adjustable locators-Redundant locators-Fool proofing-Adjustable supports and centralizes Strap clamps-cam clamps – screw clamping – latch clamps – wedge clamps – pivoted clamps- eccentric operator clamp – power clamps – quick acting clamps – equalizers.

B.Tech(Automobile Engineering) Revised Syllabus'2008

Loading and unloading problems: Loading – Entering, locating and clamping, symmetric consideration. Unloading – Bur clearance, ejectors, receivers, chip problems, relief and projection, shields and seals.

Cutter Guidance: Various types of setting blocks – Press fit bushes – Renewable bushes – Slip bushes – Threaded bushes – Special bushes – Drills with attached bushing for small holes.

Design of Jigs and Fixtures: Three construction principles- Builtup type, casting and weldment. Practicing the various types of jigs – Practicing the various types of milling fixtures – broaching fixtures – function of broaching fixtures-internal and external broaching fixtures.

References:

1. Kempster. M.H.A., Introduction to jig and tool design, ELBS Edition, 1990.
2. Henriksen, Erik.K., Jigs and Fixtures, Design Manual Industrial Press Inc., Madison Avenue, New York, 1983.
3. Donaldson G.H., Lecain, Gould. V.V., Tool design, TMH Edition, 1990
4. ASTME, Fundamentals of Tool design, Prentice Hall, 1989.
5. Joshi. P.H. Jigs and fixtures, Tata McGraw-Hill, 1988

AUE 713 : **Modern Vehicle Technology**
Contacts : **3L**
Credit : **3**

Trends in Automotive Power Plants: Hybrid Vehicles – Stratified charged / lean burn engines – Hydrogen Engines-Electric vehicles– Magnetic track vehicles.

Suspension Brakes and Safety: Closed loop suspension; Regenerative braking; Passenger comfort.

Noise Pollution and Control : Introduction, Internal and External Noise, Identification of Noise sources, Noise Control Techniques.

Vehicle Operation and Control: Fundamentals of Automotive Electronics – sensors, actuators, processors, Computer Control for pollution, noise and for fuel economy - Electronic Fuel Injection and Ignition system, Fuel Injection systems – SPFI, MPFI, DI, Pilot Injection, Unit Injection, CRDI;

Two Wheeler Technology : DTS- i, DTS – Fi, DTS – Si;

Four Wheeler Technology : VVT, Camless Engine, GD_i.

References:

1. K.K. Ramalingam, “Automobile Engineering”, Scitech Publications Pvt. Ltd., 2005
2. Dr. N.K. Giri, “Automobile Mechanic”, Khanna Publishers, 2006

AUE 714 : **Robotics and Robot Applications**
Contacts : **3L**
Credit : **3**

Introduction: Robot definition, Robotic systems - Its role in automated manufacturing; Robot anatomy; Robot classifications and specifications; Basic Robot motions -Point to point control, Continuous path control.

Components and Operations: Robot kinematics, Forward and Reverse transformation, Homogeneous Transformations. Robot Actuators and Control; Pneumatic, Hydraulic and Electrical drives and Controls used in Robots, Robot End-effectors, Mechanical, Magnetic and Vacuum Grippers, Gripping forces RCC and Design features of grippers.

Sensing and Machine Vision: Robot Sensors, Different types of Contact and Non-contact Sensors; Robot Vision and their interfaces.

Robot Programming: Robot Languages and Programming Techniques.

Industrial Applications: Applications of Robots in Materials Handling, Machine loading/unloading, Inspection, Welding, Spray painting and Finish coating, and Assembly etc.

References:

1. Industrial Robotic Technology - Programming and Application by M.P.Groover et. al., McGrawHill, 1986.

B.Tech(Automobile Engineering) Revised Syllabus'2008

2. Robotics for Engineers by Y.Koren, McGrawhill.
3. Robots Modelling Control and Applications with Software by P.G.Ranky and C.Y.Ho, Springer Verlag Berlin.
4. Robotics Technology and Flexible Automation by S.R.Deb, TMH., 1994.
5. Robotics Control, Sensing, Vision and Intelligence by K.S. Fu., R.C. Gonzalez, C.S.G.Lee, McGraw Hill, 1987.

AUE 715 : **CAD/CAM and modern manufacturing methods**
Contacts : **3L**
Credit : **3**

CAD: Design process and introduction to CAD,

Computer Graphics: concept of rasterisation, linear interpolation algorithms (DDA and Bresenham), different geometrical transformations,

Geometric modeling: wire frame, surface and solid modeling; different techniques of solid modeling, Free form surfaces – Bezier Surfaces, B-splines and NURBS Concept of a) Engineering analysis, b) Design Evaluation and Review with basics of Rapid prototyping, c) automated drafting. Benefits of CAD.

CAM: Introduction to Numerical control, Advantages and application, CNC (open loop and closed loop) , DNC and Adaptive control Components of NC and CNC machine tool, Manual programming for lathe and Computer-Assisted Part Programming using APT.

GT: Group Technology, different approaches of grouping – PFA Chart ; Rank order clustering , part classification and Coding system, composite part, different GT machine cells and layout ,From-To chart.

FMS: Comparison between automated GT and FMS, level of flexibility, Classification, different components, benefits, cutting tool management system in FMS

CIM: Introduction, Functional classification of CIM database, Communication network in CIM, advantages.

References:

1. Automation, Production Systems and Computer Integrated Manufacturing , M. P. Groover, Prentice Hall of India.
2. CAD/CAM, M.P.Groover and W.Zimmers Jr., Prentice Hall of India
3. CAD/CAM, P.N.Rao, Tata McGraw Hill Pub.
4. CAD, CAM, CIM by P.Radhakrishnan and S.Subramanyan, New Age International Publishers.

AUE 716 : **Tribology and Terotechnology**
Contacts : **3L**
Credit : **3**

Introduction to tribological systems and their characteristic features: Physico-mechanical interactions at interfacial contact surfaces;

Analysis and assessment of topography; Deterministic and stochastic tribo- models for asperity contact, frictional resistance and wear;

Frictional instability and stick-slip phenomenon; Models of adhesion-diffusion wear process; Kinetics of solid state interfacial interactions.

Principles of lubrication: Hydro-dynamic, hydro-static, elastohydrodynamic cases; Boundary film lubrication; Solid lubricants; Tribological design of machine elements and systems; Principles of life-cycle analysis and their application.

Terotechnology: Introduction, Life cycle cost analysis of plants and concept of terotechnology; Various maintenance management strategies;

Production maintenance interface and terotechnology based planning and control: Maintenance policy determination; Fixed time replacement prior to failure; Concept of health and usage monitoring of plants (HUM); Condition based maintenance; Opportunity maintenance; Design out maintenance;

B.Tech(Automobile Engineering) Revised Syllabus'2008

Preventive maintenance; Reliability, maintainability and availability of plants and equipments; Replacement strategies, Computer application in terotechnology based critical analyses.

References :

1. Tribology - a System Approach to the Science and Technology of Friction, Lubrication and Wear by Horst Czichos, Elsevier Scientific Publishing Co.
2. Principles of Tribology by Halling J. (Editor), Macmillan, London.
3. Handbook of Tribology: Materials, Coatings and Surface Treatments by Bharath Bhooshan and B. K. Gupta, McGrawhill, New York.

SEMESTER – VIII

AUE 801	:	Transport Management and Automobile Industry
Contacts	:	4L
Credit	:	4

Automobile Industry: History and development of the automobile industry; Market trends; Current scenario in Indian auto industry; Auto ancillary industries; Role of the Automobile industry in National growth – Society/ Association and Partnership.

Vehicle Maintenance: Objectives of Maintenance; Type of Maintenance - Scheduled and unscheduled maintenance; Planning and Maintenance System; Scheduling of Maintenance Work - Evaluation of PMI program, Breakdown analysis; Cost of Operation - Maintenance Cost; Indirect & Direct Cost.

Vehicle Parts, Supply Management and Budget: Stores management – Function, Objectives, Type of Stores, Stocking & Issuing of Materials; Parts Control – Identification, Methods of Parts Control - Bin tag systems; Scientific Inventory Management – Classification of Items (ABC Analysis), Order Quantity (EOQ); Budget - Budget activity, Capital expenditures, Classification of vehicle expenses.

Fleet management and Data processing : Type of Vehicles and their purpose; Management of the Fleet; Data processing systems- Software, Modems ,Computer controlling of fleet activity.

Scheduling and Fare Structure: Route planning, Scheduling of transport vehicles, Preparation of timetable, Costs, Fare structure, Methods of the fare collection, Preparation of fare table.

Motor Vehicle Act: Schedules and sections, Registration of motor vehicles, Licensing of drivers, Control of permit, Limits of speed, traffic signs. Constructional regulations. Description of goods carrier, delivery van, tanker, tipper, Municipal, fire fighting and break down service vehicle.

Management Training and Operations: Basic principles of supervising. Organising time and people. Job instruction training, training devices and techniques. Driver checklist, Tests for driver and mechanic.

References:

1. S.K. Sharma & Savita Sharma, “Industrial Engineering & Operation Management”, S.K.Kataria & Sons, 2007-2008.
2. S.L. Bhandarkar, “Vehicle Transport Management”, Dhanpat Rai & Co. (Pvt.) Ltd., 2006
3. Government Publication, The Motor Vehicle Act, 1989

AUE 891	:	Auto Scanning and Vehicle Testing Laboratory
Contacts	:	3P
Credit :	2	

Computerized engine analyzer study and practice;
Computerized wheel balancing machine study and practice;
Computerized wheel alignment machine study and practice;
Head light focusing test ;

B.Tech(Automobile Engineering) Revised Syllabus'2008

Exhaust emission test of petrol and diesel engine;

Road worthiness test: Acceleration, Gradability, Maximum speed, Constant Speed fuel consumption, City drive fuel consumption tests, Braking distance test, Visibility test.

Reference :

1. The Central Motor Vehicles Rules, 1989 (amended in 2006)
2. Automotive IndustryStandards (AISs), ARAI Publications.

AUE 898	:	Project/ Thesis
Contacts	:	12P
Credit	:	8

Each student will be assigned any one of the following types of project/ thesis work :

- (a) Industrial case study
- (b) Preparation of a feasibility report
- (c) Thesis by experimental research, and
- (d) Design and development of equipment.

Each report must contain student's own analysis or design presented in the approved format. Sessional marks will include

- (a) Evaluation of the student's progress,
- (b) Degree of involvement and participation,
- (c) Merit of the project.

A student will have to defend his/her project/ thesis and credit will be given on the merit of viva-voce examination.

AUE 881	:	Participation in Institutional Activities
Credit	:	2

The department will define and assign tasks to the students for various institutional activities and the students will submit necessary reports/ oral exam. For the purpose of evaluation.

AUE 899	:	Comprehensive Viva-Voce
Credit	:	4

A student will have to appear at the Comprehensive Viva-Voce examination of all the subjects covering the whole syllabus before a board of examiners including an external expert.

Elective Papers II

AUE 811	:	Optimisation for Engineering Design
Contacts	:	4L
Credit	:	4

Single Variable Optimization for engineering design: Introduction-Engineering optimization problems-Optimality criteria-Bracketing methods-Region elimination methods-Point estimation methods-Gradient based methods-Root finding using optimization techniques- Computer programmes.

B.Tech(Automobile Engineering) Revised Syllabus'2008

Multi Variable Optimization Algorithm: Optimality criteria-Unidirectional search-Direct search methods-gradient based methods- Computer programmes.

Constrained Optimization Algorithms: Kuhn – Tucker conditions –Transformation methods – sensitivity analysis – Direct search for constrained minimization-Linearized search techniques – feasible direct method-generalised reduction gradient method-Gradient projection method- Computer programmes.

Specialized Algorithms : Integer programming – Geometric programming.

Non-Traditional Optimization Algorithms: Genetic algorithms – Simulated annealing – Global optimization – Computer programmes.

References:

1. Kalyanmay Deb, Optimization for Engineering Design, Prentice Hall of India, New Delhi.
2. Taha. M.A., Operations Research, Macmillan, New York, 1989
3. Rao.S.S., Optimisation Theory and Application, Wiley Eastern, New Delhi, 1990
4. Muirthy, Linear Programming, Wiley, New York, 1987.
5. Rekiiaaitis. G.V. Ravindran.A. And Regedell K.M., Engineering optimization methods and applications, Wiley, New York, 1986.
6. Conley. W., Computer Optimization Techniques, Pntrecelli Book, 1980.

AUE 812 : Tractors and Farm Equipment
Contacts : 4L
Credit : 4

General Design of Tractors : Classification of Tractors-Main components of Tractor-Safety Rules.

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

Engine Frame Work and Valve Mechanism of Tractor: Cylinder and pistons-Connecting rods and crankshafts Engine balancing – Construction and operation of the valve mechanism-Valve mechanism components – Valve mechanism troubles.

Cooling system, Lubrication System and Fuel System of a Tractor: Cooling system – Classification – Liquid cooling system – Components, Lubricating system servicing and troubles – Air cleaner and turbo charger – Fuel tanks and filters –Fuel pumps.

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

References:

1. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987
2. Kolchin. A., and V.Demidov Design of Automotive engines for tractor, MIR Publishers, 1972

A U E 813 : Off Road Vehicles
Contacts : 4L
Credit : 4

Introduction: Classification of off road vehicles and their application

Excavator: Different types of Shovel and Dragline, their construction , operating principles, operating cycles . Production capacity and cost of production

Transport Equipment: Various types of Dumpers, Main system, components and Carrying capacity of Dumper

Road making and maintenance Machines: Different types of Dozer, Grader, and their construction. Operating principles, Production capacity and application mechanism.

Other equipment: Scraper and front end loader, their construction and operation

Maintenance: Maintenance aspect of Off Road vehicles.

References :

B.Tech(Automobile Engineering) Revised Syllabus'2008

1. Abrosimov, K. Bran berg, A and Katayer, K. Road Making Machinery, M I R. Publishers Moscow. 1971
2. De, A. Latest Development of Heavy Earth Moving Machinery, Annapurna Publishers, Dhanbad 1995
3. Nichols, Herber L (Jr.), Moving the Earth, Galgotia Publishing House, New Delhi, 1962.
4. Rudnev, V. K. , Digging of soils by earthmover with Power Parts, Oxanian Press Pvt. Ltd., New Delhi, 1985

AUE 814 : **Total Life Cycle Management**
Contacts : **4L**
Credit : **4**

Definition of total life cycle (TLC)-Concept of TLC-Life cycle impacts-Integrating life cycle technologies-Products and processes within TLC-TLC methodology-TLC assessment data to complex products-Results Improvement for product.

Vehicle End Life: Design for end of old vehicle management –Problems of old vehicles in emerging markets-recovery and economic feasibility of materials such as Plastics, rubber aluminum, steel, etc.

Tradeoffs: Applying life cycle thinking to define tradeoffs along the supply, manufacture-use and end of life chain-Effect on the customer- Expectation of the customer-Evaluate product cost on fuel consumption, emissions, durability, environment and health.

Sustainability: What is sustainability-Use of renewable resources-View to design horizon.

Harmonization of Environmental Goals: TLC for emerging vs. developed markets-Rules and regulations to guide designers-International common practices for end of life vehicles.

References :

1. Dr. K. C. Arora, Total Quality Management. S.K. Kataria & Sons, 2007-08.

AUE 815 : **Computer Simulation of IC Engines Processes**
Contacts : **4L**
Credit : **4**

Introduction: Introduction-Heat of reaction-Measurement of URP-Measurement of **HRP-Adiabatic flame temperature:** Complete combustion in C/H/O/N Systems, Constant volume adiabatic combustion, constant pressure adiabatic combustion. Calculation of adiabatic flame temperature-Isentropic changes of state SI Engine **Simulation With Air As Working Medium:** Deviation between actual and ideal cycle-Problems, I engine simulation with adiabatic combustion, temperature drop due to fuel vapourisation, full throttle operation-efficiency calculation, part-throttle operation, super charged operation.

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

Simulation of 2-Stroke SI Engine: Diesel Engine Simulation: Multi Zone model for combustion, different heat transfer models, equilibrium calculations, simulation of engine performance, simulation for pollution estimation.

References:

1. Ganesan. V. Computer Simulation of spark ignition engine process, Universities Press (I) Ltd. Hyderabad, 1996.
2. Ramoss. A.L., Modelling of Internal Combustion Engines Processes, McGraw Hill Publishing Co., 1992.
3. Ashley Campbel, Thermodynamic analysis of combustion engines, John Wiley & Sons, New York, 1986
5. Benson. R.S., Whitehouse. N.D., Internal Combustion Engines, Pergamon Press, Oxford, 1979.

B.Tech(Automobile Engineering) Revised Syllabus'2008

AUE 816 : Non-Destructive Testing Methods
Contacts : 4L
Credit : 4

Non-Destructive Testing (NDT), Nondestructive Evaluation (NDE), Nondestructive Inspection (NDI)
:

Visual/ Optical Examination: Principal, Procedure, Instrument, Applications.

Liquid Penetrating technique: Principle, Procedure, Applications.

Magnetic Particle Testing : Principle, Procedure, Applications.

Eddy Current Testing : Principle, Procedure, Applications.

Ultrasonic Testing: Principle, Procedure, Applications.

Radiography: Principle, Procedure, Applications.

Thermography: Principle, Procedure, Applications.

Accoustic emission testing : Principle, Procedure, Applications.

Comparision and Selection of NDT Methods : Inspection of Raw materials, Inspection of Secondary Processing, In-service Damage Inspection.

Common Application of NDT :

Codes Standards, Specifications and Procedures :

References:

1. Non-Destructive Testing by Warren J.Mcgomnagle, McGrawhill.
2. Non-Destructive Testing by Baldev Raj et. al., Narosa Publishing House.

AUE - 817 : Industrial Engineering
Contacts : 3L
Credit : 3

Selection of plant location, factors, dimensional analysis, Brown and Gibsons method, multi plant location analysis, Transportation and p-center model;

Layout and line balancing, RPWT technique, problems, design of layout for repetitive, functional and cellular processes, computerized relative allocation of facilities technique (CRAFT),production flow analysis;

Work study, method study, charting techniques, diagrams, exercises;

Work measurement; work sampling, time study, Rating, Allowances;

Network Analysis, PERT & CPM, Resource leveling;

Value Engineering, definition, implementation and methodology, matrix systems, examples;

Decision making theory, types of decision making environment, methods and tools, examples;

Job evaluation and merit rating, computer aided analysis of scheduling and inventory models, ergonomics;

References:

1. S.N.Chary, Production and Operations Management , Tata McGraw Hill
2. Joseph .S. Martinich, Production and Operations Management , John Wiley and Sons.
ILO, Work Study
3. Barry Render and Ralph.M.Stain.Jr. , Quantitative Analysis for Management
4. P.Gopalkrishnan and M.Sundaram, Material management, an integrated approach
5. M. Mohajan, Industrial Engineering and production management

AUE 818 : Automotive Air-conditioning.
Contacts : 3L
Credit : 3

Fundamentals of Refrigeration Air-conditioning , simple vapour compression refrigeration system (V.C.R.S), Refrigerants, Driers, Lubricants, Refrigeration components and controls: components, condenser, evaporators, valves electrical circuits and devices, etc.

Psychometrics, human comfort. Air-conditioning equipment, components and controls.

Installation of Air conditioning system in vehicle

B.Tech(Automobile Engineering) Revised Syllabus'2008

Load estimation : heat transfer from exterior wall, passenger, Equipment and infiltrated air. Heater system for winter conditioning, Requirement of air and air distribution systems, duct design, duct systems.

Power required for Air-conditioning system of passenger car, multi utility and commercial vehicle.

Maintenance and repair of air conditioning Air-conditioning system .

References:

1. Stoecker W F & Jones J W Refrigeration & Air-conditioning. Tata. Mc Graw- Hill Publishing Company Limited, 1982
2. Giri N K Automotive Technology, Khanna Publishers 2004
3. De A Automobile engineering, Galgotia publishing house 2004

AUE 819 : **Finite Element Methods and its Application**
Contacts : **4L**
Credit : **4**

Introduction : Review of various approximate methods in structural analysis. Stiffness and flexibility matrices for simple cases. Basic concepts of finite element method. Formulation of governing equations and convergence criteria.

Discrete Elements: Use of bar and beam elements in structural analysis. Computer implementation of procedure for these elements.

Continuum Elements: Different forms of 2D elements and their applications for plane stress, plane strain and axi-symmetric problems.

Consistent and lumped formulation. Use of local coordinates. Numerical integration.

ISO Parametric Elements: Definition and use of different forms of 2D and 3D elements. Computer implementation of formulation of these elements for the analysis of typical structural parts.

Solution Schemes: Different methods of solution of simultaneous equations governing static, dynamic and stability problems. General purpose software packages.

References:

1. Segerlind. L.J., Applied Finite Element Analysis, Secon Edition, John Wiley and Sons Inc., New York, 1984.
2. Bathe.K.J. and Wilson. E.L., Numerical methods in finite element analysis, Prentice Hall of India Ltd., 1983.
3. Cook. R.D., Concepts and Applications of Finite Element analysis, 3rd Edition, John Wiley & Sons, 1989.
4. Krishnamurthy. C.S., Finite Element Analysis, Tata McGraw Hill., 1987
5. Ramamurthi.V., Computer Aided Design in Mechanical Engineering, Tata McGraw Hill, 1987.

Elective Papers – III

AUE 821 : **Alternate Fuels and Energy Systems**
Contacts : **4L**
Credit : **4**

Introduction: Important properties(Calorific value , Flash point, fire point, pour point, cloud point, viscosity, Cetane and Octane number etc) of a fuel. General characteristics of SI & CI Engines fuels, estimation of petroleum reserve, need for alternate fuel, availability of various alternative fuels, general use of Alcohols,LPG,Hydrogen,CNG, LNG, Vegetable oils and Biogas.

Solar Energy: Semiconductor and Photovoltaic effect, Solar Cell, advantages & disadvantages of Solar Energy, application of solar energy.

Alcohols: Properties as engine fuels, merits and demerits, alcohol as SI and CI engine fuel, alcohols with gasoline& diesel blends, Combustion characteristics and emission characteristics in engines.

Natural Gas: Source and composition of CNG, Properties, advantages &disadvantages, performance and emission characteristics of CNG.

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LPG: Source, Compositions & Properties, Performance & Emission of LPG. Components of LPG kit .

Hydrogen: Production, Storage ,Handling, Safety ,properties and Performance of Hydrogen.

Vegetable Oils & Bio-diesel: Composition & Properties of various vegetable oils for engines; Trans-esterification reaction and bio-diesel production , Performance and emission characteristics of Bio-diesel.

Fuel Cells: Types of fuel cell, advantages & disadvantages and applications.

References:

1. Maheswar Dayal, Energy today & tomorrow, I & B Horishr India,1982
2. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill Co., 2004
3. SAE paper Nos.840367, 841156,841333,841334.
5. The properties and performance of modern alternate fuels SAE paper No 841210.
6. Bechtold.R.L. Alternative Fuels Guide Book, SAE, 1997.

AUE 822 : **Microprocessor Application in Automobiles**
Contacts : **4L**
Credit : **4**

Architecture: General 8 bit microprocessor and its architecture 8085,Z-80 and MC 6800 MPU and its pin functions-Architecture-Functions of different sections.

Instruction Set: Instruction format-addressing modes-instruction set of 8085 MPU-T-STATE-Machine cycle and instruction cycles-Timing diagrams-Different machine cycles-Fetch and execute operations-estimation of execution times.

Assembly Language Programming: Construct of the language programming-Assembly format of 8085-Assembly Directive-Multiple precision addition and subtraction-BCD to Binary and Binary to BCD Multiplication, Division, Code conversion using look up tables-stack and subroutines.

Data Transfer Schemes: Interrupt structure-Programmed I/O, DMA-Serial I/O.

Interfacing Devices: Types of interfacing devices-Input/Output ports 8212, 8255,8251,8279. Octal latches and tristate buffers-A/D and D/A converters-Switches, LED's ROM and RAM interfacing.

Applications: Data acquisitions-Temperature control-Stepper motor control-Automotive applications engine control, Suspension system control, Driver information systems, Development of a high speed, high precision learning control system for the engine control.

References:

1. Ramesh, Goankar.S., Microprocessor Archietecture Programming and Applications, Wiley Eastern Ltd.,New Delhi,1986.
2. Aditya .P. Mathur, Introduction to Microprocessors, III Edition Tata McGraw Hill Publishiung Co Ltd New Delhi,1989.
3. Ahson. S. I., Microprocessors with Applications in Process Control,Tata McGraw Hill New Delhi,1986.
4. SAE Transactions,1986 Sec 3.
5. Jabez Dhinagfar .S., Microprocessor Applications in Automobiles.
6. L. Bianco and A. Labella., Automotive Micro Electronics, Elsevier science Publishers,1986.

AUE 823 : **Gas Turbine Engines**
Contacts : **4L**
Credit : **4**

Illustration of working of gas turbine engine - The thrust equation - Factors affecting thrust - Effect of pressure, velocity and temperature changes of air entering compressor - Methods of thrust augmentation – Characteristics of turboprop, turbofan and turbojet - Performance characteristics.

Internal flow and Stall in Subsonic inlets - Boundary layer separation - Major features of external flow near a subsonic inlet - Relation between minimum area ratio and external deceleration ratio - Diffuser performance -Supersonic inlets - Starting problem in supersonic inlets - Shock swallowing by area variation – External deceleration - Modes of inlet operation.

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Classification of combustion chambers - Important factors affecting combustion chamber design – Combustion process - Combustion chamber performance - effect of operating variables on performance - Flame tube cooling- Flame stabilization - Use of flame holders - Numerical problems.

Theory of flow in isentropic nozzles - Convergent nozzles and nozzle choking - Nozzle throat conditions - Nozzle efficiency - Losses in nozzles - Over expanded and under-expanded nozzles - Ejector and variable area nozzles - Interaction of nozzle flow with adjacent surfaces - Thrust reversal.

Principal of operation of centrifugal compressor - Work done and pressure rise - Velocity diagrams – Diffuser vane design considerations - Concept of prewhirl - Rotating stall - Elementary theory of axial flow compressor -Velocity triangles - degree of reaction - Three dimensional flow - Air angle distributions for free vortex and constant reaction designs - Compressor blade design - Centrifugal and Axial compressor performance characteristics.

Aircraft Gas Turbines:

Impulse and reaction blading of gas turbines - Velocity triangles and power output - Elementary theory – Vortex theory - Choice of blade profile, pitch and chord - Estimation of stage performance - Limiting factors in gas turbine design - Overall turbine performance - Methods of blade cooling - Matching of turbine and compressor - Numerical problems.

References:

1. Cohen, H.Rogers, G.F.C. and Saravanamuttoo, H.I.H. " Gas Turbine Theory ", Longman, 1989.
2. Mathur, M.L., and Sharma, R.P.," Gas Turbine and Jet and Rocket Propulsion ", Standard Publishers and Distributors, Delhi, 1988.
3. Oates, G.C. " Aerothermodynamics of Aircraft Engine Components ", AIAA Education Series, New York, 1985.

AUE 824 : **Management Information Systems**
Contacts : **4L**
Credit : **4**

Introduction to Management Information Systems (MIS); Data, information and knowledge concepts, concepts of information representation:

storage, dissemination, discrimination and transmission.

Data base management systems, design and implementation of RDBMS for managerial applications, retrieval aspects, and security and privacy aspects.

Specification and configuration of computer based systems; Manufacturing Management Information systems- its subsystems and outputs; costing and performance audit applications in MIS.

References :

1. Management Information Systems, Organisation and Technology by Loudon and Loudon, 4th ed., Prentice Hall.

AUE 825 : **Total Quality Management**
Contacts : **4L**
Credit : **4**

Basic Concepts : definitions, elements and principles, difference between traditional approach & TQM approach.

Process control: Machine and process capability analysis. Use of control charts and process engineering techniques for implementing the quality plan.

Considerations in Quality Assurance & Design : Quality assurance concept, system, planning, Vendor approval, support, qualification, certification and supplier system (ASQC).

Planning Process for TQM Implementation : planning, leadership & commitment, infrastructure, measurement, education & training, resources, supplier and customer alignment.

B.Tech(Automobile Engineering) Revised Syllabus'2008

Emerging concepts of quality management: Taguchi's concept of off-line quality control and Ishikawa's cause and effect diagram.

References:

1. Total Quality Management – Dr. K.C. Arora, S.K. Kataria & Sons, 2006.
2. Industrial Engineering & Management by O.P. Khanna, Dhanpat Rai, 1999.

IT 806 : Information Technology
Contacts : 4L
Credit : 4

Hardware: CPU architecture, memory, registers, addressing modes, buses, instruction sets, multi processors versus single processors;

Peripheral devices: hard disks, CDs, video display monitors, device controllers, input/output; operating systems - functions and types;

Operating system modules: processes, process management, memory and file system management; examples of hardware architectures; examples of operating systems; basic network components, switches, multiplexers and media; installation and configuration of multi user operating systems.

Data structure and representation: characters, records, files, multimedia; precision of data; information representation, organisation and storage; algorithm development; object representation compared to conventional data flow notation; programming control structures; program correctness, verifications and validations; file structures and representation.

Communication devices, media, systems; network hardware and software; network configuration; network applications; coding of data; cost/benefit analysis; distributed versus centralised systems; architectures, topologies and protocols; installation and operation of bridges, routers and gateways; network performance analysis; privacy, security, reliability; installation and configuration of LAN and WAN networks; monitoring of networks; management of telecommunications and communications standards. Intranet and Internet.

References:

1. Computer Architecture and Organisation – John. P. Haryes, Tata McGraw Hill
 2. Data Structure and Program Design – Robert L. Kruse, PHI
 3. Modern Operating System – Andrew S. Tanenbaum, PHI
 4. Data and Computer Communication – William Stallings, PHI
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