Automobile Engineering Syllabus

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**

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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.

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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**

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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:

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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:

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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

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AUE 713 Modern Vehicle Technology
PE 807 Computer Integrated Manufacturing
ME 702 Advances in Materials Processing
ME 805 Tribology and Terotechnology
ME 812 Robotics and Robot Application

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
ME 801 Industrial Engineering
ME 807 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 Navigational Aids and Guidence
ME 813 Management Information Systems
ME 821 Total Quality Management
IT 806 Information Technology
IT 816 Entrepreneurship and E-business

Semester-wise Credits

Semester	Number of Theory Papers	No. of Practical Papers	No. of Sessional Papers	Credits
Semester III	**5**	**4**	**-**	**26**
Semester IV	**6**	**4**	**1**	**28**
Semester V	**5**	**4**	**1**	**28**
Semester VI	**5**	**4**	**1**	**28**
Semester VII	**5**	**2**	**2**	**28**
Semester VIII	**3**	**1**	**3**	**28**

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.
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. Beams of uniform strength.

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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, 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. Combined bending and torsion.
Deflection of Beams: Differential equation of the elastic axis, double integration and moment methods. Strain energy in tension, compression, shear, bending and torsion. Castigiliano'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. Malhotra.D.R, and Gupta.H.C, The Strength of Materials, Satya Prakashan Tech., India Punlications, New Delhi, 1995.
3. Kazimi.S.M.A., Solid Mechanics, Tata McGraw Hill, 1976.
4. Dym.C.L, and Shames.I.H., Solid Mechanics, McGraw Hill, Kogakusha, Tokyo, 1973.
5. Khurmi.R.S, Strength of Materials, S.C Chand and Co, 1998.

AUE 302 : Fluid Mechanics and Machinery
Contacts : 3L + 1T
Credit : 4

Introduction: Classification of fluids. Properties of fluids. Centre of pressure. Plane and curved surfaces. Buoyancy and stability of floating bodies.
Fluid Dynamics: Laws of kinematics of fluid flow. Lagrangian and Eulerian method. Stream function and potential functions. Continuity, momentum and energy equations. Bernoulli's equations and its applications. Pressure measurements, pitot static tube, venturimeter, and orifice plate. Applications of momentum equations.
Dimensional Analysis: Buckingham's theorem, Non-dimensional numbers, similarities of flow. Model studies.
Laminar and Turbulent Flows: Reynolds experiments. Flow relation between shear stress and pressure gradient. Flow between parallel plates. Characteristics of turbulent flow. Flow through pipes. Energy losses in pipes. Flow around immersed bodies.
Fluid Machinery: Principles of operations of centrifugal and axial pumps. Turbo blowers and turbines. Principles and working of gear, vane and reciprocating pumps.

References:

1. Shames I.H., Mechanics of Fluids, Kogakusha, Tokyo, 1998.
2. Rathakrishnan.E, Introduction to Fluid Mechanics, PrenticeHall, India, 1999.
3. Yuvan.S.W, Foundation of Fluid Mechanics, Prentice Hall, 1998
4. Milne Thomson, L.M., Theoretical Hydrodynamics, McMillan, 1985.
5. Kumar.K.L, Fluid Mechanics, Eurasia Publishing House, 1990.

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., Fundamentalss 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.

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Casting: sand-casting, types, procedure to make sand moulds, cores-moulding tools, pouring of metals, principle of die casting. Centrifugal casting. Investment casting Shell moulding and CO2 process.
Welding: Classification of welding processes. Principles and equipment used in Gas welding, Arc welding, Resistance welding, Thermitt welding. Soldering. Brazing.
Conventional Machining: General principles of working. Types and commonly performed operations in Lathe, Shaper, Planer, Milling machine, Drilling machine, Grinding machine, Gear cutting.
Unconventional Machining: Need for unconventional machining processes. Principles and application of Abrasive jet machining, Ultrasonic machining, Electro discharge machining, Electromechanical machining, Chemical machining, Laser beam machining, Electron beam machining, Plasma arc machining.
Metal Forming: Basic concepts and classification of forming processes. Principal equipment used and application of Forging, Rolling, Extrusion, Wire drawing, Spinning.
Powder metallurgy, steps involved, applications.

References:

1. Hajra Choudhury, Elements of Workshop Technology, Vol-I and Vol-II Asia Publishing House, 1996.
2. R.K.Jain and S.C.Gupta, Production Technology, Hanna Publishers, 1997.
3. H.M.T. Production Technology-Hand Book, Tata McGraw Hill, 1990

M 303 : Mathematics
Contacts : 3L + 1T
Credits : 4

Allotted Hrs.:48L

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. *12L*

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. *10L*

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. *14L*

Linear Programming Problem (L.P.P):

Mathematical Formulation, Graphical Solution and Simplex Method, Charnes Big-M Method, Transportation Problems, Assignment Problems (Hungarian Method). *12L*

Total ***48L***

Reference:

1. Higher Engineering Mathematics by Dr. B. S. Grewal
2. Linear Programming & Game Theory by Chakraborty & Ghosh
3. Complex Variables by M. R. Spiegel
4. Partial Differential Equation by K. S. Rao
5. Engineering Mathematics, Arumugam, Scitech.

AUE 391 : Strength of Materials Laboratory
Contacts : 3P
Credits : 2

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

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AUE 392 : Fluid Mechanics and Machinery Laboratory
Contacts : 3P
Credits : 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 :

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
Credits : 2

Computer aided drafting problems, Dimension and geometrical tolerancing, Surface modules and representation, Examples.
Problems of two and three-dimensional geometric models, Solid modeling based applications,
Partial views and scientific problems, Auxiliary sections, Simple mechanical assembly drawings, Schematic product symbols for standard components in mechanical, electrical and electronic systems, welding symbols.

SEMESTER-IV

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

Solution of equations and eigenvalue 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. Eigenvalue 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 quardrature 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 Gumnavathy, 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

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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.
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.
2. Heat Transfer by J.P.Holman, 8th ed., McGrawhill.
3. Elements of Heat & Mass Transfer by Vijay Gupta, 2nd ed., New Age International Publishers.
4. Heat Transfer - A Basic Approach by M.N.Ozisik, McGrawhill.

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

Engine Construction and Operation: Constructional details of 4-stroke petrol engine. Working principle, Otto cycle, actual indicator diagram. Two stroke engine construction and operation. Comparison of four stroke and two-stroke engine operation. Firing order and its significance.
SI Engine Fuel System: Carburettor working principle. Requirements of an automotive carburettor; Starting, idling, acceleration and normal circuits of carburettors, compensation, Maximum power devices, constant choke and constant vacuum carburetors. Fuel feed systems, Mechanical and electrical pumps. Petrol injection.
Cooling and Lubrication System: Need for cooling system. Types of cooling system, Liquid cooled system, Thermosyphon system, Pressure cooling system. Lubrication system, Mist lubrication system, Wet sump and dry sump lubrication. Properties of lubricants. Properties of coolants.
Combustion and Combustion Chambers: Combustion in SI engines, stages of combustion, flame propagation, rate of pressure rise, abnormal combustion, knocks. Effect of engine variables and knock. Combustion chambers, Different types, Factor controlling combustion chamber design.
Two Stroke Engines: Types of two strokes engines, Terminologies and definitions, Theoretical scavenging methods. Scavenging pumps. Types of scavenging.

References:

1. Ganesan.V, Internal Combustion Engines, Tata McGraw Hill Publishing Co., New York, 1994.
2. Heldt.P.M, High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1975.
3. Obert.E.F, International Combustion Engines Analysis and Pratice, International Text Book Co., Scranton, Pennsylvania, 1988.
4. Wiliam.H.Crouse, Automotive Engines, McGraw Hill Publishers, 1985.
5. Ellinger.H.E, Automotive Engines, Prentice Hall Publishers, 1992

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

Mechanisms and machines; Elements of kinematic chain, mobility and range of movements, miscellaneous mechanisms, Straight line generating mechanisms. Intermittent motion mechanism.
Velocity and acceleration- analysis of displacement, planar mechanisms by graphical, analytical and computer aided methods, Synthesis of linkages, Kinematic analysis of machine elements, Freudeustein's equation, Dimensional analysis for motion, Functioning and path generation.
Dynamics of rotary and reciprocating machines, Critical speeds, Turning moment diagrams and flywheels, Cam profile analysis, gear tooth profiles, static and dynamic force analysis of constrained kinematic systems, Precisional motions and gyroscopic stability.

References:

1. Mechanism and Machine Theory by J.S.Rao and R.V.Dukkipati, New Age International.
2. Theory of Machines and Mechanisms by J.J.Shigley and J.J.Uicker, McGrawhill.
3. Theory of Machines by S.S.Rattan, TMH.

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

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General considerations and procedure of machine design, design stress, factor of safety, stress and deflection analysis, engineering materials and applications, fits and tolerances, design of fasteners and fastenings - pin, cotter, knuckle, screw, rivets and welded joints. Design of shafts and couplings, common power and force transmitting power screws, belt drives and springs.

References:

1. Mechanical Engineering Design by J.F.Shigley, McGrawhill.
2. Design of Machine Elements by M.F.Spotts, Prentice Hall.
3. Mechanical Analysis and Design by A.H.Burr and J.B.Cheathak, 2nd ed., Prentice Hall.

AUE 406 : 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, velocity, 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.
Metrology: Standards, slip gauges, Measurement of angles, tapers, threads, coordinates, inspection of straightness, flatness, alignment and surface finish, gear measurements, Measurements of various product features using Mechanical, Pneumatic, Optical and Electronic Instruments, Interferometry and use of optical flats.

References:

1. Experimental Methods for Engineers by J.Holman, 6th ed. McGrawhill.
2. Mechanical Measurements by T.G.Beckwith, N.L.Buck and R.D.Marangoni, 3rd ed., Narosa Publishing House.
3. Measurement Systems - Application and Design by E.O.Doeblin, 4th ed., McGrawhill.
4. Instrumentation, Measurement and Analysis by B.C.Nakra and K.K.Chaudhary, TMH.
5. Metrology for Engineers by J.W.F. Gallies and C.R.Shotbolt, Cassel.
6. Metrology by R.K.Jain.

AUE 492 : Thermal Engineering Laboratory
Contacts : 3P
Credit : 2

Experiments on heat transfer: thermal conductivity of solids, liquids and gases, natural and forced convection, boiling heat transfer, cooling tower;
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

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

Drafting exercises involving preparation of detailed drawings of product assembly
Aggregation of assembly, exploded machine kinematics, foundation of structure Drawings and multilayered system drawing, Computer aided drafting using softwares like CATIA, AUTOCAD and Pro Engineer.

Automobile Engineering Syllabus

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

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

1.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).
2. 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)
3. 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)
4. 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)
5. 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)
6. 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, TMH
2. How to prepare for Group Discussion & Interview (With Audio Cassette) by Prasad, TMH
3. Spoken English – A self-learning guide to conversation practice (with Cassette) by Sasikumar, TMH

SEMESTER-V

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

Design for variable loads: Endurance limit, Goodman and Soderberg criteria, Design of shafts, clutches and brakes - calculation of heat generation and heat dissipation; Gears: Gear tooth geometry, tooth systems, gear trains, gear box design, design of helical, bevel and worm gears from strength and wear considerations; Flywheel design; Bearings and lubrication: selection procedure of antifriction bearings, journal bearings, hydrodynamic theory, design factors, the relation of the variables, heat balance, hydrostatic bearings. Concept of concurrent and simultaneous engineering. Example problems in design of mechanical systems.

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.
3. Mechanical Engineering Design by J.E.Shigley, McGraw hill.

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

Engine construction and operation. Two stroke and four stroke diesel engines. Diesel cycle. Fuel-air and actual cycle analysis. Diesel fuel, Ignition quality. Cetane number.
Fuel Injection System: Requirements, Air and solid injection, function of components, Jerk and distributor type Pumps. Pressure waves, Injection lag, Unit injector, Mechanical and Pneumatic governors. Fuel injector-types of injection nozzle, Spray characteristics, injection timing, pump calibration.
Combustion Chambers: Importance of air motion-swirl, squish and turbulence-swirl ratio. Fuel air mixing –stages of combustion, delay period, factors affecting delay period. Knock in CI engines-comparison of knock in CI & SI engines. Direct and indirect injection. Combustion Chambers-Air cell chamber, combustion chamber design objectives. Different types of combustion chamber.
Supercharging and Turbocharging: Necessity and limitation, Charge cooling, Types of supercharging and turbocharging, relative merits, matching of turbocharger.
Diesel Engine Testing and Performance: Automotive and stationary diesel engine testing and related standards. Engine power and efficiencies. Performance characteristics. Variables affecting engine performance. Methods to improve engine performance. Heat balance. Performance maps.

References:

1. Ganesan.V.Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi, 1994.
2. Heldt.P.M.,High Speed Combustion Engines, Oxford IBH Publishing Co.,1985.
3. Obert.E.F.,Internal Combustion Engine analysis and Pratice,International Text Book Co.,Scranton,Pennsylvania,1988.
4. Maleev.V.M, Diesel Engine Operation and Maintenance, McGraw Hill, 1974.
5. Dicksee.C.B, Diesel Engines, Blackie & Son Ltd., London, 1964.

AUE 503 : Materials Science and Technology
Contacts : 4L
Credit : 4

Elasticity. Stress and strain relationship in engineering materials. Deformation mechanism. Strengthening material: Strain hardening, alloying, polyphase mixture, martensitic, precipitation, dispersion, fibre and texture strengthening. Iron carbon diagram.
Fracture, Fatigue and Creep: Fracture, classification and types, Griffith's theory, notch effects, stress concentration, concept of fracture toughness. Ductile brittle transition. Fatigue Mechanism of crack initiation and growth, factors affecting fatigue creep, creep curve, Ashby deformation mechanism maps, and creep mechanism, metallurgical variables of creep.
Characteristics of Materials: Castability, machinability, formability and weldability of engineering materials such as steel, cast iron, alloy steels, brass, bronze and aluminum alloys.
Composite materials: fabrication techniques, materials for high temperature. Cryogenic wear, corrosion fatigued creep and oxidation resistance application.
Selection of materials: Criteria of selecting materials for automotive components viz Cylinder block, Cylinder head, Piston, Piston ring, Gudgeon pin, Connecting rod, Crank shaft, Crank case, Cam, Cam shaft, Engine valve, Gear wheel, Clutch plate, Axle bearings, Chassis, Spring, body panel radiator, brake lining etc. Application of non-metallic materials such as composite, ceramic and polymers in automobile.
Heat Treatment and Surface Treatment: Heat treatment of steel. Annealing –types, normalising, hardening and tempering with specific relevance to automotive components, surface hardening techiniques, induction flame and chemical hardening. Coating and corrosion resistance. Electroplating, phosphating, anodizing, hot dipping, thermal spraying, hard-facing and thin film coatings.

References:

1. Khanna.O.P.Material Science and Metallurgy, Dhanpat Rai & Sons, 1992.
2. Kapoor, Material Science and Processes, New India Publishing House, 1987.
3. Dieter, G.E., Mechanical Metallurgy, McGraw Hill, New York, 1972.
4. Avner.S.H.Introduction to physical metallurgy, McGraw Hill, New York, 1982.
5. Raghavan.V.Physical Metallurgy, Principle and Pratice, Prentice Hall, 1995.
6. Bawa.H.S.Materials Metallurgy, McGraw Hill, 1986.

AUE 504 : Power Units and Transmission
Contacts : 4L
Credit : 4

Requirement of transmission system.
Different types of clutch: Principle, construction, torque capacity and design aspects.
Determination of gear ratios for vehicles. Performance characteristic in different speeds. Different types of gearbox, conventional gearbox.
Hydrodynamic Drive: Fluid coupling: Principle of operation. Constructional details, torque capacity. performance characteristics, reduction of drag torques.
Torque Converter: Principle of operation, constructional details, performance characteristics, converter coupling, multistage torque converters and polyphase torque converters.
Automotive Transmission: Ford—T-model gearbox, Wilson gearbox, Electro-magnetic transmission, Automatic overdrive, Hydraulic control system for automatic transmission.
Hydrostatic Drive and Electric Drive: Hydrostatic drive: Various types of hydrostatic drive systems-Principles of hydrostatic drive system, Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive, Construction and working of typical Janny hydrostatic drive.
Electric drive: Principles of early and modified Ward Leonard Control system, advantages & limitations. performance characteristics.
Automatic Transmission Applications: Chevrolet "Turboglide" transmission, power glide transmission, Toyota "ECT-I" automatic transmission with intelligent electronic control system. Clutch hydraulic actuation system.

References:

1. Heldt.P.M.Torque Converters, Chilton Book Co., 1992.
2. Newton and Steeds, Motor Vehicles, Illiffe Publishers, 1985.
3. Judge.A.W.Modern Transmission Systems, Chapman and Hall Ltd., 1990.
4. SAE Transactions 900550 & 930910.
5. Hydrostatic transmissions for vehicle applications, I Mech E Conference, 1981-88.
6. Crouse.W.H.Anglin.,Automotive Transmission and Power Trains Construction, McGraw-Hill, 1976.

AUE 505 : Automotive Chassis

Automobile Engineering Syllabus

Contacts : 3L

Credit : 3

Introduction: Types of chassis layout with reference to power plant locations and drive. Vehicle frames. Various types of frames. 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. Steering of crawler tractors.
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, Sprial bevel gear and hypoid gear final drives. Double reduction and twin speed final drives. Differential principles. Construction details of differential unit. Non-slip differential. 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. Multi axles vehicles. Construction details of multi drive axle vehicles.
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. Heldt.P.M.,Automotive Chassis, Chilton Co., New York,1990.
2. Steed.W.,Mechanics of Road Vehicles,IIIiffe Books Ltd.,London,1960.
3. Newton. Steeds & Garrot.Motor Vehicles, Butterworths, London, 1983.
4. Judge.A.W.Mechanism of the car, Chapman and Halls Ltd., London1986.
5. Giles.J.G.,Steering Suspension and tyres,IIIiffe Book Co.,London,1988.
6. Crouse.W.H, Automotive Chassis and Body, McGraw Hill New York, 1971

AUE 591 : Design Practice
Contacts : 3P
Credits : 2

Drawing board exercises compatible to the course AUE 405 : Design of Machine Elements.

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
Credits : 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

AUE 597 : Manufacturing Process Laboratory - III
Contacts : 3P
Credits : 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

Batteries: Principles and construction of lead-acid battery. Characteristics of battery, rating capacity and efficiency of batteries. Various tests on battery condition, charging methods. Constructional aspect of alkaline battery.
Starting System: Condition at starting. Behavuiour of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units, care and maintenance of starter motor. Starter Switches.

Automobile Engineering Syllabus

Charging System: Generation of direct current. Shunt generator characteristics. Armature reaction. Third brush regulation. Cut-out. Voltage & current regulators. Compensated voltage regulator alternators principle & constructional aspects and bridge benefits.
Ignition Systems : Types, Construction & working of battery coil and magneto ignition systems. Relative merits, Centrifugal and vacuum advance mechanisms, types and construction of spark plugs, electronic ignition systems.
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.
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, Bently Publishers, 1997.
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 Griffths. 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 Jersy, 1988.
13. Bechtold, Understanding Automotive electronics, SAE, 1998.
14. T.Mellard Automotive Electronics.

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

Car Body Details: Types: Saloon, Convertibles, Limousine, Estate van, racing and sports car. Visibility: regulations, driver's visibility, test for visibility, Methods of improving visibility and space in cars. Safety: safety design, safety equipments for car. Car body construction.
Vehicle Aerodynamics: Objectives, Vehicle drag and types, various types of forces and moments, Effects of forces and moments, side wind effects on forces and moments, various body optimization techniques for minimum drag. Wind tunnel testing: Flow visualization techniques, scale model testing. Component balance to measure forces and moments.
Bus Body Details: Types, mini bus, single decker, double decker, two level, split level and articulated bus. Bus Body Lay Out: Floor height, engine location, entrance and exit location, seating dimensions. Constructional details: Frame construction, Double skin construction-Types of metal section used-Regulations-Conventional and Integral type construction.
Commercial Vehicle Details: Types of body, Flat platform, drop side, fixed side, tipper body, tanker body. Light commercial vehicle body types, Dimensions of driver's seat in relation to controls, driver's cabin design.
Body Materials, Trim And Mechanisms: Steel sheet, timber, plastics, GRP, properties of materials-Corrosion anticorrosion methods, scalation of paint and painting process, body trim items. Body mechanisms.

References:

1. Powloski. J. Vehicle Body Engineering, Business Books Ltd., 1989.
2. Giles. J.C. Body construction and design, IIliffe Books Butterworth & Co., 1971
3. John Fenton, Vehicle Body layout and analysis, Mechanical Engg Publication Ltd., London, 1982
4. Braithwaite.J.B., Vehicle Body building and drawing, Heinemann Educational Books Ltd., London, 1977.

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

Automobile Engineering Syllabus

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 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.

References:

1. Irving. P.E., Motor cycle Engineering, Temple Press Book, London, 1992
2. The Cycle Motor Manual, Temple Press Ltd., London, 1990.
3. Encyclopedia of Motorcycling, 20 volumes, Marshall Cavensih, New York and London, 1989.
4. Bryaut. R.V., Vespa Maintenance and Repair series.
5. Raymond Broad, Lambretta – A practical guide to maintenance and repair, 1987

AUE 604 : Automotive Pollution and Control
Contacts : 4L
Credit : 4P

Introduction: Pollutants-sources-formation-effects-transient operational effects on pollution.

SI engine Combustion and Pollutant Formation: Chemistry of SI engine Combustion, HC and CO formation in 4 stroke and 2 stroke SI engines, NO formation in SI Engines, Effect of operating variables on emission formation.

Cl engine Combustion and Emissions: Basic of diesel combustion-Smoke emission in diesel engines-Particulate emission in diesel engines. Color and aldehyde emissions from diesel engines, Effect of operating variables on emission formation.

Control Techniques for SI and CI: Design changes, optimization of operating factors, exhaust gas re-circulation, fumigation, air injector PCV system-Exhaust treatment in SI engines-Thermal reactors-Catalytic converters, Catalysts, Use of unleaded petrol.

Test Procedure & Instrumentation for Emission Measurement and Emission Standards: Test procedures-NDIR analyzer, Flame ionization detectors, Chemiluminescent analyzer, Gas chromatograph, Smoke meters, Emission standards.

Reference:

1 Springer and Patterson, Engine Emission, Plenum Press, 1990
2 Ganesan. V., Internal Combustion Engines, Tata McGraw Hill Co., 1994.
3 SAE Transactions, Vehicle emission, 1982 (3 volums).
4 Obert. E.F., Internal Combustion Engines, 1982.
5 Taylor. C.F., Internal Combustion Engines, MIT Press, 1972.
6 Heywood. J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co., 1995.
7 Automobiles and Pollution SAE Transaction, 1995

AUE 605 : Quality Control and Reliability Engineering
Contacts : 3L
Credit : 4P

Quality Concepts: Quality-Factors influencing quality, quality costs, economics of quality, quality assurance-statistical tools used in quality in SQC, Quality planning, Organization for quality. Bureau of Indian standards, ISO 9000-quality circles KAIZEN-TQM concepts-Quality audit.

Statistical Process Control: Variation in processes, Factors, Process capability, Analysis of process capability, control charts, variables, Attributes, Establishing and interpreting control charts, X,R, chart for variables, defects, P chart, C-chart and U chart-Con-troll charts for defective quality rating

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

Life Testing-Reliability-Systems Approach: Life testing-objectives-classification-failure characteristics-failure data analysis-mean time to failure-maintainability and availability-reliability-system reliability-series and parallel systems-systems 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, failsafe systems-optimization in reliability, product design, product analysis, product development product cycle.

References:

1. Betster field D.H. Quality Control-Prentice Hall Pub (1993) (Revised Edn.)
2. Sharma S.C. Inspection Quality Control and Reliability –Khanna Publishers New Delhi (1998)
3. John Bank, The Essence of Total Quality Management, Prentice Hall of India P Ltd New Delhi 1995.
4. Danny Samson, Manufacturing & Operations strategy. Prentice Hall New York (1991)
5. Ganapathy K. Subramaniam B. Narayana V-Quality Circle concepts and implementation – QCFI. Secondrabad 919940.
6. Tapan P. Bagchi ISO9000. Concepts methods and implementation – Wheeler Publisher Allahbad (1994)

7. Conner P.D.T.O. Practical Reliability Engineering John Wiley (1993)
8. Green A.E. and Bourne A.J. Reliability, Technology, Wiley Interscience 1991.

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 out.

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 NO_x analyzer
Measurement of HC, CO, CO_2, O_2 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

Design and drawing of piston, piston pin and piston rings.
Design and drawing of connecting rod small end and big end, shank design, design of big and cap bolts and drawing of the connecting rod assembly.
Design and drawing of crankshaft, balancing weight calculations, development of short and long crankarms,front end and rear end details.
Design and drawing of flywheel, ring gear design.
Design and drawing of the inlet and exhaust valves.

References:

1 Heldt. P.M. High speed combustion engine, Chilton Books Co., 1952
2 Giles. J.G., Engine design, IIIiffe Books Ltd., London, 1962.
3 Newton. K. and Steeds. W., The Motor Vehicle, The Engilish Language Book Society and Newnes Butterworth, London, 1972.
4 Khovak, Motor vehicle engines, MIR Publishers.
5 Kolchin. A. and Demidov.V.Design of Automotive Engines.

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, sutudy 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 tyre 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

Introduction: Fundamentals of vibration, Mechanical vibrating systems. Modeling & simulation. Model of an automobile-Single, two, multi degrees of freedom systems-Free, forced and damped vibration. Magnification factor-Transmissibility, Vibration absorber.
Multi Degree Of Freedom Systems: Closed coupled system, Eigen valve problems, Far coupled systems-Orthogonality of mode shapes-Modal analysis, Forced vibration by matrix inversion.
Suspension and Tyres: Requirements. Spring mass frequency. Wheel hop, wheel wobble, wheel shimmy. Choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and apt directions. Ride characteristics of tyres, behaviour while cornering, power consumed by tyre, effect of driving and braking torque-Gough's tyre characteristics.
Vehicle Handling: Oversteer, under steer, steady state concerning. Effect of braking, driving torques on steering. Effect of camber, transient effects in concerning. Directional Stability of vehicles.
Stability of Vehicles: Load distribution. Calculation of tractive effort and reactions for different drives-Stability of a vehicle on a slope, on a curve and a banked road.
Numerical Methods: Approximate methods for fundamental frequency, Dunker-Ley's lower bound, Rayleigh's upper bound-Holzer method for close-coupled systems and branched systems.

References:

1 Gillespie. T.D., Fundamentals of vehicle dynamics society of Automotive Engineers, Ic USA 1992
2 Heldt. P.M. Automotive Chassis, Chilton co., New York, 1992
3 Ellis.J.R., Vehicle Dynamics, Business Books Ltd., London, 1991.
4 Giles. J.G. Steering, Suspension and Tyres, IIIifee Books Ltd, London, 1988.
5 Giri. N.K. Automobile Mechanics, Khanna Publishers. New Delhi, 1986.
6 Rao. J.S. & Gupta. K., Theory and Practice of Mechanical Vibrations, Wiley Eastern Ltd., New Delhi, 1999.

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, dual simplex method, transportation and assignment problems, Project Management: CPM and PERT, Queuing theory, Game theory, Markov chain, Monte Carlo Simulation.
Industrial Management: Principles and functions of Management: Leadership and decision making,
Human resources: personnel management, industrial legislation and relations, industrial psychology, manpower planning, training and development, health, safety, welfare, remuneration and incentive schemes.
Materials, Purchase and Stores Management: Inventory control.
Sales and Marketing Management.
Cost Accounting and Control, Budget and Budgetary control.

References :

1. Production Systems: Planning, Analysis and Control by J.L.Riggs, 3rd ed., Wiley.
2. Productions and Operations Management by A.Muhlemann, J.Oakland and K.Lockyer, Macmillan.
3. Operations Research - An Introduction by H.A.Taha, Prentice Hall of India.
4. Operations Research by J.K.Sharma, Macmillan.

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

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

Automobile Engineering Syllabus

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.

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.

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

Design and drawing of Cam and Camshaft, Cam profile generation.
Design of combustion chamber.
Design and drawing of engine complete assembly with cylinder block, cylinder head, crankcase, valve ports, water jackets, front and rear end details.
Clutch: Components and assembly drawing using CAD Software.
Gear Box: Gear train calculations. Layout of gearbox. Calculation of bearing loads and selection of bearings. Complete assembly drawing using CAD Software.

References:

1. Heldt. P.M. High speed combustion engine, Chilton Books Co., 1952.
2. Giles. J.G., Engine design, IIliffe Books Ltd.., London, 1962.
3. Newton. K. and Steeds. W., The Motor Vehicle, The English Language Book Society and Newnes Butterworth, London, 1972.
4. Khovak, Motor vehicle engines, MIR Publishers.
5. Kolchin. A. and Demidov. V. Design of Automotive Engines.

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 an Automobile components. An industrial project may also be undertaken by the student to be supervised jointly by industry personnel and the teacher.

Automobile Engineering Syllabus

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Elective Papers I

AUE 711 : Advanced Manufacturing Technology
Contacts : 3L
Credits : 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 surfaceses-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.
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
Credits : 3

Trends in Automotive Power Plants: Hybrid Vehicles – Stratified charged / lean burn engines – Hydrogen Engines-battery vehicles – Electric propulsion with cables – Magnetic track vehicles.
Suspension Brakes and Safety: Air suspension-Closed loop suspension-antiskid braking system, Retarders, Regenerative braking safety cage-air bags-crash resistance – passenger comfort.oise & Pollution: Reduction of noise – Internal & external pollution control through alternate fuels/ power plants-Catalytic converters and filters for particular emission.
Vehicle Operation and Control: Computer Control for pollution and noise control and for fuel economy-Transducers and operation of the vehicle like optimum speed and direction.
Vehicle Automated Tracks: Preparation and maintenance of proper road network-National highway network with automated roads and vehicles-Satellite control of vehicle operation for safe and fast travel.

References:

1. Beranek. L.L. Noise Reduction, McGraw-Hill Book Co., Inc, Newyork, 1993
2. Bosch Hand Book, 3rd Edition, SAE,1993

PE 807 : Computer Integrated Manufacturing
Contact : 3L
Credits : 3

Concept of Computer Integrated Manufacturing (CIM); Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors.
Computer Aided Design (CAD): CAD hardware and software; product modeling, automatic drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre.
Computer Aided Manufacturing (CAM): Computer assisted NC part programming; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirements planning (MRP); computer aided production scheduling; computer aided inspection planning; computer aided inventory planning; flexible manufacturing system (FMS); concept of flexible manufacturing; Integrating NC machines, robots, AGVs, and other NC equipment; Computer aided quality control; business functions, computer aided forecasting.
Management Information Systems (MIS), Various CIM systems - examples.

References :

1. CAD, CAM, CIM by P.Radhakrishnan and S.Subramanyan, New Age International Publishers.
2. Computer Integrated Manufacturing by Paul G. Rankey, Prentice Hall.
3. Computer Integrated Manufacturing by Harrington J. Jr., Industrial Press, Inc., New York.
4. Computer Integrated Manufacturing by K.Rathmill and P.Macconal, IFS Publications.
5. Automation, Production Systems and Computer Integrated Manufacturing by M. P. Groover, Prentice Hall.

ME 702 : Advances in Materials Processing
Contacts : 3L
Credits : 3

Introduction to advanced materials: composites, ceramics, refractory metals and alloys, super alloys; Solidification processing: principles of solidification, processing and applications of recent solidification techniques like infiltration techniques, rheocasting, squeeze casting, compocasting, rapid solidification techniques and zone refining; Powder metallurgy processing: Metal and ceramic powder production, characterisation, mixing techniques; Mechanical alloying and process variables; Various compaction techniques and the process variables; Mechanism of sintering and various sintering techniques, viz., solid state sintering, liquid phase sintering, reaction sintering, hot pressing, HIP and self propagating combustion sintering; Recent advances in powder metallurgy like Ospray and Deposition techniques.

References :

1. Fundamentals of Solidification by W.Kurtz and D.J.Fisher, Trans. Tech Publication.
2. Rapidly Solidified Metals by T.R.Anantharaman and C.Suryanarayana, Trans. Tech Publications.
3. Modern Ceramic Engineering by D.W.Richardson, Marcel Dekker Inc..

ME 805 : Tribology and Terotechnology
Contact : 3L
Credits : 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 aheso-diffusion wear process; Kinetics of solid state interfacial interactions.
Principles of lubrication: Hydro-dynamic, hydro-static, elatso-hydrodynamic 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 tero-technology; 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; Preventive maintenance; Reliability, maintainability and availability of plants and equipments; Replacement strategies, Computer application in terotechnology based critical analyses.

References :

1. Tribology - a System Approah 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.

ME 812 : Robotics and Robot Applications
Contact : 3L
Credits : 3

Robot definition: Robotic systems - Its role in automated manufacturing; robot anatomy; robot classifications and specifications.
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.
Robot sensors, different types of contact and non-contact sensors; Robot vision and their interfaces;

References:

1. Industrial Robotic Technology - Programming and Application by M.P.Groover et. al., McGrawhill
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 Technologies and Flexible Automation by S.R.Deb, TMH.**

SEMESTER –VIII

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

Automobile Engineering Syllabus

Management Training and Operations: Basic principles of supervising. Organising time and people. Job instruction training, training devices and techniques. Driver and mechanic hiring. Driver checklist, Lists for driver and mechanic. Trip leasing. Vehicle operation and types of operation.
Vehicle Maintenance: Scheduled and unscheduled maintenance Planning and scope. Evaluation of PMI program, Work scheduling, Overtime, Breakdown analysis, Control of repair backlogs, Cost of options.
Vehicle Parts, Supply Management and Budget: Cost of inventory, Balancing inventory cost against downtime, Parts control, Bin tag systems. Time management, Time record keeping, Budget activity, Capital expenditures, Classification of vehicle expenses. Fleet management and data processing, Data processing systems- Software. Models – Computer controlling of fleet activity. Energy management.
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.

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.

References:

1. John Dolu, Fleet Management, McGraw Hill Co., 1984
2. Government Publication, The Motor Vehicle Act, 1989
3. Kitchin. L. D., Bus Operation, IIliffe and Sons Ltd., London, III Edition, 1992
4. Kadiyali. L.R., Traffic Engineering and Transport Planning.

AUE 891 : Auto Scanning and Vehicle Testing Laboratory
Contact : 3P
Credits : 2

Computerized engine analyzer study and practice; Computerized wheel balancing machine study and practice: Computerized wheel alignment machine study and practice; Exhaust emission test of petrol and diesel engine; Two wheeler chassis dynamometer study and practice; Road worthiness test: Acceleration, Gradability, Maximum speed, Constant Speed fuel consumption, City drive fuel consumption tests; Head light focusing test ; Visibility test; Braking distance test.

Automobile Engineering Syllabus

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 metho0ds-Gradient based methods-Root finding using optimization techniques-Computer programmes.

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-Unearized 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. **Rekiaaitis. 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

AUE 813 : Off-Road Vehicles
Contacts : 4L
Credit : 4

Classification and Requirements of Off Road Vehicles: Power plants, chassis and transmission, Multiaxle vehicles.
Land clearing machines: Bush cutter, stumpers, Tree dozer, Rippers.
Earth Moving Machines: Bulldozers, cable and hydraulic dozer. Crawler trach, running and steering gears, scrapers, drag and self powered types – Dump track and dumpers – Loaders, single bucket, multi bucket and rotary types- Power and capacity of earth moving machines.
Scrapers and Graders: Scrapers, elevating graders, self powered scrapers and graders.

Shovels and Ditchers : Power shovel, revolving and stripper shovels – drag lines – ditchers – Capacity of shovels.

References:

1. Abrosimov.K. Bran berg. A. and Katayer. K., Road making Machinery, MIR Publishers, Moscow, 1971.
2. Wang. J.T., Theory of Grand vehicles, John Wiley & Sons, New York, 1987
3. Off the road Wheeled and combined traction devices – Ashgate Publishing Co. Ltd. 1988.

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 accessment 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.

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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.

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, constsant 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
4. Benson. R.S., Whitehouse. N.D., Internal Combustion Engines, Pergamon Press, Oxford, 1979.

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

Non-Destructive Testing: Introduction, classification of NDT techniques,
Visual examination: Bore-scopes, video devices,
Magnetic particle testing: Operating principal, magnetising technique.
Liquid Penetrating technique: Principle, process description.
Ultrasonic Testing: Definition, advantages and applications, inspection methods.
Radiography: Electromagnetic radiation sources, process description.
Thermography: Infrared theory, contact, non-contact methods.
Accoustic emission testing, eddy current testing,
Leak testing: Bubble emission testing, Air leak testing.
Case studies on defects in casting, rolling, welding, and heat-treating.

References:

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

ME 801 : Industrial Engineering
Contacts : 4L
Credits : 4

Production Planning and Control; Product: product design, customer requirements, value engineering, quality, reliability, service life, and competitiveness;
Plant: location, layout, material handling, equipment selection, maintenance of equipment and facilities;
Processes: Job, batch and flow production methods, Group Technology Work study and Time and Motion study, Work/job evaluation, quality control (SPC), control charts;
Resource planning: production/ operation control, forecasting, capacity management, scheduling and loading, line balancing, break-even analysis, inventory of materials and their control, manufacturing planning, MRP - II, JIT.

References :

1. Production, Planning and Inventory Control by S.L.Narasimhan, D.W.McLeavey, P.J.Billington, Prentice Hall.
2. Production Systems: Planning, Analysis and Control by J.L.Riggs, 3rd ed., Wiley.
3. Productions and Operations Management by A.Muhlemann, J.Oakland and K.Lockyer, Macmillan.

Automobile Engineering Syllabus

ME 807 : Finite Element Methods and its Application
Contacts : 4L
Credit : 4

Introduction : Review of various approximate methods in structural analysis. Stiffness and flexibility matrics 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 strees, 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.

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Elective Papers - III

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

Introduction: Estimation of petroleum reserve-Need for alternate fuel-Availability and properties of alternate fuels-general use of alcohols-LPG-Hydrogen-Ammonia, CNG, and LNG-Vegetable oils and Biogas-Merits and demerits of various alternate fuels. Alcohols: Properties as engine fuels, alchohols and gasoline blends-Combustion characteristics in engines-emission characteristics.
Natural Gas, LPG, Hydrogen and Biogas: Availability of CNG, properties modification required to use in engines-performance and emission characteristics of CNG using LPG in SI & CI engines. Performance and emission for LPG-Hydrogen-Storage and handling, performance and safety aspects.
Vegetable Oils: Various vegetable oils for engines-Esterification-Performance in engines-Performance and emission characteristics.
Electrical and Solar Powered Vehicles: Layout of an electric vehicle-Advantage and limitations-Specifications-System component, Electronic control system-High energy and power density batteries-Hybrid vehicle-Solar powered vehicles

References:

1. Maheswar Dayal, Energy today & tomorrow, I & B Horishr India,1982
2. Nagpal, Power Plant Engineering, Khanna Publishers,1991.
3. Alchohols and Motor fuels progress in technology, Series No.19,SAEPublicartion USA 1980.
4. 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 Publishuing 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.

ME 813 : Management Information Systems
Contact : 4L
Credits : 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.

ME 821 : Total Quality Management
Contact : 4L
Credits : 4

Basic concepts, definitions and history of quality control. Quality function and concept of quality cycle. Quality policy and objectives. Economics of quality and measurement of the cost of quality. Quality considerations in design.

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Process control: Machine and process capability analysis. Use of control charts and process engineering techniques for implementing the quality plan.
Acceptance Sampling: single, double and multiple sampling, lot quality protection, features and types of acceptance sampling tables, acceptance sampling of variables and statistical tolerance analysis. Quality education, principles of participation and participative approaches to quality commitment.
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 – An Introductory Text by Paul James, Prentice Hall
2. Quality Control and Applications by Housen & Ghose
3. Industrial Engineering Management by O.P. Khanna

IT 806 : Information Technology
Contact : 4L
Credits : 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

IT 816 : Entrepreneurship and E-Business
Contact : 4L
Credits : 4

Introduction: Concept of Entrepreneurship - need and scope for entrepreneurship - Entrepreneur and society - qualities of entrepreneur Risks, relevance and benefits of small scale Industry - definition of tiny, small ancillary industry - prevailing industrial policy of SSI - incentives and benefits of SSI units.
Motivation theories - Maslow, McCllend - Motivation model - need, want, motive and behaviour - attitude towards work - self assessment and goal setting - Achievement, motivation and behaviour measurement, SWOT analysis, TA analysis - Stress and conflict management; coping with uncertainty; creativity and innovation.
Project identification and formulation: Sources of information - opportunity guidance - choice of technology and its evaluation;
Consumer behaviour; market survey and research; demand and resource based industry- servicing industry - import substitution- Techno economic feasibility assessment - short listing, preliminary project report, detailed project report, assessing viability and feasibility of a report.
Forms of business organisations/ownership - formation of a Company - procedures and formalities for setting up of new industry- sources of information to contact for what and where - subsidies and concessions for SSI - role of State and Central Government Agencies in promotion of Small Scale Industry. Sickness and nursing of sickness in SSI. Labour Laws - The Factories Act 1948, Minimum Wages Act - Payment of Wages 1936, Workmen Compensation Act, 1923.
Taxation - State and Central - Concessions.
Introduction to e-business; EDI and e-commerce; EDI standard, implementation and Tools; e-commerce imperatives,
e-commerce applications: I - Markets, Customer care, Vendor Management and Extended supply chain management; security aspects - cryptography, digital signature, digital watermarking, secured socket layers, understanding threats to security, securing internet connections, Firewall techniques, electronic payment systems - ATM model, Payment Models, credit card based payment system, 1st virtual banking, e-cash, smart cards; Electronic Data interchange EDI) - Value added networks.

References:

1. Handbook for New Enterpreneurs, EDII, Ahmedabad.
2. Entrepreneurial Development by P.Saravanavel.