

ANNA UNIVERSITY CHENNAI :: CHENNAI 600 025

AFFILIATED INSTITUTIONS

CURRICULUM – R 2008

B.E AUTOMOBILE ENGINEERING

SEMESTER – VI

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

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
MG2351	Principles of Management	3	0	0	3
AU2351	Automotive Engine Components Design	3	1	0	4
AU2352	Automotive Chassis Components Design	3	1	0	4
AU2353	Two and Three Wheelers	3	0	0	3
ME2353	Finite Element Analysis	3	1	0	4
	Elective I	3	0	0	3
PRACTICAL					
AU2354	Computer Aided Engine Design Laboratory	0	0	3	2
AU2355	Computer Aided Chassis Design Laboratory	0	0	3	2
AU2356	Two and Three Wheelers Laboratory	0	0	3	2
	TOTAL	18	3	9	27

SEMESTER – VII

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

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
AU2401	Engine and Vehicle Management Systems	4	0	0	4
AU2402	Vehicle Dynamics	3	1	0	4
AU2403	Vehicle Maintenance	3	0	0	3
AU2404	Automotive Pollution and Control	3	0	0	3
	Elective-II	3	0	0	3
	Elective-III	3	0	0	3
PRACTICAL					
AU2405	Vehicle Maintenance and Re-conditioning Laboratory	0	0	3	2
ME2309	CAD and CAM Laboratory	0	0	3	2
	TOTAL	19	1	6	24

SEMESTER – VIII

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

Code No.	Course Title	L	T	P	C
THEORY					
AU2451	Vehicle Body Engineering	3	0	0	3
	Elective-IV	3	0	0	3
	Elective-V	3	0	0	3
PRATICAL					
AU2452	Comprehension	0	0	2	1
AU2453	Project Work	0	0	12	6
	TOTAL	9	0	14	16

LIST OF ELECTIVES

ELECTIVES FOR VI SEMESTER

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
GE2021	Professional Ethics In Engineering	3	0	0	3
AU2021	Automotive Air-conditioning	3	0	0	3
AU2022	Alternate Fuels and Energy Systems	3	0	0	3
AU2023	Vibration , Noise and Harshness Control	3	0	0	3
AU2024	Advanced Theory of I.C. Engines	3	0	0	3
ME2021	Quality Control and Reliability Engineering	3	0	0	3
AU2037	Metrology and Instrumentation	3	0	0	3

ELECTIVES FOR VII SEMESTER

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
AU2026	Supercharging And Scavenging	3	0	0	3
AU2027	Automotive Aero-dynamics	3	0	0	3
ME2030	Composite Materials	3	0	0	3
ME 2029	Design of Jigs, Fixtures and Press Tools	3	0	0	3
AU2028	Computer Simulation of I.C. Engines	3	0	0	3
ME2028	Robotics	3	0	0	3
AU2029	New Generation and Hybrid Vehicles	3	0	0	3
AU2030	Off Road Vehicles	3	0	0	3
AU2031	Project and Material Management	3	0	0	3
AU2032	Engine Auxiliary Systems	3	0	0	3

ELECTIVES FOR VIII SEMESTER

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
MG2021	Marketing Management	3	0	0	3
ME2035	Entrepreneurship Development	3	0	0	3
AU2033	Automotive Safety	3	0	0	3
AU2034	Fuel Cell Technology	3	0	0	3
ME2038	Operations Research	3	0	0	3
AU2035	Transport Management	3	0	0	3
GE2022	Total Quality Management	3	0	0	3

UNIT I	OVERVIEW OF MANAGEMENT	9
Definition - Management - Role of managers - Evolution of Management thought - Organization and the environmental factors – Trends and Challenges of Management in Global Scenario.		
UNIT II	PLANNING	9
Nature and purpose of planning - Planning process - Types of plans – Objectives - - Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions.		
UNIT III	ORGANIZING	9
Nature and purpose of organizing - Organization structure - Formal and informal groups / organization - Line and Staff authority - Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment - Orientation - Career Development - Career stages – Training - - Performance Appraisal.		
UNIT IV	DIRECTING	9
Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership Styles - Leadership theories - Communication - Barriers to effective communication - Organization Culture - Elements and types of culture - Managing cultural diversity.		
UNIT V	CONTROLLING	9
Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control - Quality Control - Planning operations.		

TOTAL= 45 PERIODS

TEXT BOOKS:

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.

REFERENCES:

1. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global & Entrepreneurial Perspective', Tata Mcgraw Hill, 12th edition, 2007.
3. Andrew J. Dubrin, 'Essentials of Management', Thomson Southwestern, 7th edition, 2007.

OBJECTIVE

- To make the students understand the design concept and principles of various engine components. These concepts and principles are familiarized for design of components.

UNIT I INTRODUCTION 12

Engineering materials - Introduction endurance limit, notch sensitivity. Tolerances, types of tolerances and fits, design considerations for interference fits, surface finish, surface roughness, Rankine's formula - Tetmajer's formula - Johnson formula- design of push- rods.

UNIT II DESIGN OF CYLINDER, PISTON AND CONNECTING ROD 12

Choice of material for cylinder and piston, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly. Material for connecting rod, determining minimum length of connecting rod, small end design, shank design, design of big end cap bolts.

UNIT III DESIGN OF CRANKSHAFT 12

Balancing of I.C. engines, significance of firing order. Material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations, development of short and long crankarms. Front and rear-end details.

UNIT IV DESIGN OF FLYWHEELS 12

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

UNIT V DESIGN OF VALVES AND VALVE TRAIN 12

Design aspects of intake & exhaust manifolds, inlet & exhaust valves, valve springs, tappets and valve train. Design of cam & camshaft. Design of rocker arm. Cam profile generation.

LECTURES : 45 TUTORIALS : 15 TOTAL : 60 PERIODS

Note: (Use of P S G Design Data Book is permitted in the University examination)

TEXT BOOKS

1. Khurmi. R.S. & Gupta. J.K., A textbook of Machine Design, Eurasia Publishing House (Pvt) Ltd, 2001.
2. Giri.N.K, Automobile Mechanics, Khanna Publishers, New Delhi, 2007.

REFERENCE

1. Jain.R.K, "Machine Design", Khanna Publishers, New Delhi, 2005.

OBJECTIVE

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

UNIT I VEHICLE FRAME AND SUSPENSION 12

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

UNIT II FRONT AXLE AND STEERING SYSTEMS 12

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

UNIT III CLUTCH 12

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

UNIT IV GEAR BOX 12

Gear train calculations, layout of gearboxes. Calculation of bearing loads and selection of bearings. Design of three speed and four speed gearboxes.

UNIT V DRIVE LINE AND REAR AXLE 12

Design of propeller shaft. Design details of final drive gearing. Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings and design aspects of final drive.

LECTURES : 45 TUTORIALS : 15 TOTAL : 60 PERIODS

TEXT BOOKS

1. Giri, N.K., Automobile Mechanics, Khanna publishers, New Delhi, 2007.
2. Khurmi. R.S. & Gupta. J.K., A textbook of Machine Design, Eurasia Publishing House (Pvt) Ltd, 2001.

REFERENCES

1. Heldt, P.M., Automotive Chassis, Chilton Book Co., 1992.
2. Dean Averns, Automobile Chassis Design, Illife Book Co., 2001.

OBJECTIVE

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

UNIT I POWER UNIT 9

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

UNIT II CHASSIS AND SUB-SYSTEMS 9

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

UNIT III BRAKES, WHEELS AND TYRES 9

Drum brakes, disc brakes, front and rear brake links, layouts. Spoked wheel, cast wheel, disc wheel, disc types. Tyres and tubes.

UNIT IV TWO WHEELERS 9

Case study of major Indian models of motorcycles, scooters and mopeds. TVS mopeds and motorcycles, HeroHonda motorcycles, Bajaji scooters and motorcycles, Yamaha, Enfield motorcycles. Servicing and maintenance.

UNIT V THREE WHEELERS 9

Case study of Indian models. Auto rickshaws, pickup van, delivery van and trailer. Maintenance:& Fault tracing.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Irving.P.E. - Motor Cycle Engineering - Temple Press Book, London – 1992.
2. The Cycle Motor Manual - Temple Press Limited, London - 1990

REFERENCES

1. Encyclopedia of Motorcycling - 20 volume Marshall, Cavensih, UK - 1989
2. Brayant R.V,Vespa - Maintenance and Repair Series – S.Chand & Co., New Delhi - 1986.
3. Raymond Broad Lambretta - A Practical Guide to maintenance and repair – S.Chand & Co., New Delhi - 1987.

INTRODUCTION (Not for examination)

Solution to engineering problems – mathematical modeling – discrete and continuum modeling – need for numerical methods of solution – relevance and scope of finite element methods – engineering applications of FEA

UNIT I FINITE ELEMENT FORMULATION OF BOUNDARY VALUE PROBLEMS**5 + 3**

Weighted residual methods –general weighted residual statement – weak formulation of the weighted residual statement –comparisons – piecewise continuous trial functions- example of a bar finite element –functional and differential forms – principle of stationary total potential – Rayleigh Ritz method – piecewise continuous trial functions – finite element method – application to bar element

UNIT II ONE DIMENSIONAL FINITE ELEMENT ANALYSIS**8 + 4**

General form of total potential for 1-D applications – generic form of finite element equations – linear bar element – quadratic element –nodal approximation – development of shape functions – element matrices and vectors – example problems – extension to plane truss– development of element equations – assembly – element connectivity – global equations – solution methods –beam element – nodal approximation – shape functions – element matrices and vectors – assembly – solution – example problems

UNIT III TWO DIMENSIONAL FINITE ELEMENT ANALYSIS**10 + 4**

Introduction – approximation of geometry and field variable – 3 noded triangular elements – four noded rectangular elements – higher order elements – generalized coordinates approach to nodal approximations – difficulties – natural coordinates and coordinate transformations – triangular and quadrilateral elements – iso-parametric elements – structural mechanics applications in 2-dimensions – elasticity equations – stress strain relations – plane problems of elasticity – element equations – assembly – need for quadrature formulæ – transformations to natural coordinates – Gaussian quadrature – example problems in plane stress, plane strain and axisymmetric applications

UNIT IV DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD**8 + 4**

Introduction – vibrational problems – equations of motion based on weak form – longitudinal vibration of bars – transverse vibration of beams – consistent mass matrices – element equations –solution of eigenvalue problems – vector iteration methods – normal modes – transient vibrations – modeling of damping – mode superposition technique – direct integration methods

UNIT V APPLICATIONS IN HEAT TRANSFER & FLUID MECHANICS**6 + 3**

One dimensional heat transfer element – application to one-dimensional heat transfer problems- scalar variable problems in 2-Dimensions – Applications to heat transfer in 2-Dimension – Application to problems in fluid mechanics in 2-D

LECTURES : 45 TUTORIALS : 15 TOTAL : 60 PERIODS**TEXT BOOKS**

1. P.Seshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007. ISBN-978-203-2315-5.
2. J.N.Reddy, "An Introduction to the Finite Element Method", McGraw-Hill International Editions(Engineering Mechanics Series), 1993.ISBN-0-07-051355-4

REFERENCES

1. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice-Hall of India, Eastern Economy Editions. ISBN-978-81-203-2106-9
2. David V.Hutton,"Fundamentals of Finite Element Analysis", Tata McGraw-Hill Edition 2005. ISBN-0-07-239536-2
3. Cook,Robert.D., Plesha,Michael.E & Witt,Robert.J. "Concepts and Applications of Finite Element Analysis",Wiley Student Edition, 2004. ISBN-10 81-265-1336-5

AU2354 COMPUTER AIDED ENGINE DESIGN LAB

L T P C
0 0 3 2

LIST OF EXPERIMENTS

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

TOTAL : 45 PERIODS

LIST OF EQUIPMENTS

(For a batch of 30 students)

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

AU 2355 COMPUTER AIDED CHASSIS DESIGN LAB

L T P C
0 0 3 2

LIST OF EXPERIMENTS

CLUTCH

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

GEAR BOX

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

DRIVE LINE AND REAR AXLE

8. Design of propeller shaft.
9. Design details of final drive gearing.
10. Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings
11. Design aspects of final drive.

TOTAL : 45 PERIODS**LIST OF EQUIPMENTS**

(for a batch of 30 students)

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

AU2356**TWO AND THREE WHEELERS LAB****L T P C****0 0 3 2****LIST OF EXPERIMENTS**

1. Performance test of a two wheeler using chassis dynamometer.
2. Performance test on shock absorber
3. Performance test on coil spring.
4. Two wheeler chain test
5. Brake and Clutch adjustment as per specification.
6. Dismantling and assembling of two wheeler gear box and finding gear ratios
7. Dismantling and assembling of three wheeler box and finding gear ratios
8. Three wheeler brake and clutch play adjustment
9. Dismantling and assembling of three wheeler steering system.
10. Study of three wheeler chassis frame and power transmission system.

TOTAL: 45 PERIODS**LIST OF EQUIPMENTS**

(for a batch of 30 students)

- | | |
|------------------------------------|----------|
| 1. Two wheeler chassis dynamometer | - 1 No. |
| 2. Coil spring test rig | - 1 No. |
| 3. Chain tension test rig | - 1No. |
| 4. Shock absorber test rig | - 1 No. |
| 5. Two-wheeler gearbox | - 2 Nos. |
| 6. Two-wheeler clutch | - 2 Nos. |
| 7. Three-wheeler brake assembly | - 2 Nos. |
| 8. Three-wheeler steering assembly | - 2 Nos. |
| 9. Three-wheeler gear box | - 2 Nos. |

OBJECTIVE

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

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 10

Microprocessor architecture, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines and in the other parts of the automobile.

UNIT II SENSORS 12

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

UNIT III SI ENGINE MANAGEMENT 13

Three way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control. Electronic ignition systems and spark timing control. Closed loop control of knock.

UNIT IV CI ENGINE MANAGEMENT 13

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

UNIT V VEHICLE MANAGEMENT SYSTEMS 12

ABS system, its need, layout and working. Electronic control of suspension – Damping control, Electric power steering, Supplementary Restraint System of air bag system – crash sensor, seat belt tightening. Cruise control. Vehicle security systems-alarms, vehicle tracking system. On board diagnostics. Collision avoidance Radar warning system.

TOTAL : 60 PERIODS

TEXT BOOKS

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

REFERENCES

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

OBJECTIVE

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

UNIT I INTRODUCTION 9

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

UNIT II STABILITY OF VEHICLES 9

Load distribution, calculation of acceleration, tractive effort and reactions for different drives, stability of a vehicle on a curved track, slope and a banked road,.

UNIT III MULTI DEGREE FREEDOM SYSTEMS 9

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

UNIT IV SUSPENSION, TYRES AND VEHICLE HANDLING 9

Requirements, sprung mass frequency, wheel hop, wheel wobble, wheel shimmy, choice of suspension spring rate, calculation of effective spring rate, vehicle suspension in fore and aft, roll axis and vehicle under the action of side forces, tyre, dynamics, ride characteristics power consumed by a tyre. Oversteer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering.

UNIT V NUMERICAL METHODS 9

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., 2002.
2. Giri N.K – Automotive Mechanics, Khanna Publishers, 2007.

REFERENCES

1. Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication - 2002.
2. Ellis.J.R - "Vehicle Dynamics"- Business Books Ltd., London- 1991
3. Gillespie T.D, "Fundamentals of Vehicle Dynamics", SAE USA 1992.
4. Giles.J.G.Steering - "Suspension and Tyres", Illiffe Books Ltd., London- 1998

OBJECTIVE

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

UNIT I MAINTENANCE OF RECORDS AND SCHEDULES 10

Requirements and importance of maintenance, types of maintenance, preparation of check lists, Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance. Motor vehicle acts, insurance etc and traffic rules, motor vehicle driving rules and regulation.

UNIT II ENGINE MAINTENANCE – REPAIR AND OVERHAULING 9

Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up, including modern engines.

UNIT III CHASSIS MAINTENANCE - REPAIR AND OVERHAULING 10

Mechanical and automobile clutch, fluid flywheel, torque converter, automatic transmission and gear box, servicing and maintenance. Maintenance servicing of propeller shaft and differential system. Maintenance servicing of suspension systems. Brake systems, types and servicing techniques. Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing.

**UNIT IV ELECTRICAL AND ELECTRONIC SYSTEM MAINTENANCE –
SERVICING AND REPAIRS 8**

Testing methods for checking electrical and electronic components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

**UNIT V MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS,
LUBRICATION SYSTEM AND VEHICLE BODY 8**

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating system maintenance.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. John Doke "Fleet Management", McGraw-Hill Co. 1984.
2. Automotive Mechanics W.H. Crouse

REFERENCES

1. James D Halderman - Advanced Engine Performance Diagnosis–PHI 1998.
2. Service Manuals from Different Vehicle Manufacturers.
3. Automobile Engineering by Kribal Singh
4. Bosch Hand Book – 3rd Edition SAE 1993.

OBJECTIVE

- To make the students to realize the impact of automobile emissions on the environment and expose student to factors affecting the formation and control of automobile pollutants.

UNIT I INTRODUCTION 8

Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming, types of emission, transient operational effects on pollution, noise vibration and harshness (NVH).

UNIT II POLLUTANT FORMATION IN ENGINES 12

Pollutant formation in Engines, mechanism of HC and CO formation in four stroke and two stroke engines, NO_x formation in engines, smoke and particulate emissions in CI engines, effects of design and operating variables on emission formation, control of evaporative emission. Two stroke engine pollution.

UNIT III CONTROL OF EMISSIONS FROM ENGINES 9

Design strategies to control emission from engines, optimum selection of operating variables for control of emissions, EGR, Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution control.

UNIT IV NOISE POLLUTION FROM AUTOMOBILES 8

Noise, Vibration And Harshness, Sources of Noise, Measurement of Noise -Engine Combustion Noise, Inlet And Exhaust Noise, Traffic Noise, Vehicle Body Noise - control of noise, control devices and noise proof materials.

UNIT V MEASUREMENT TECHNIQUES EMISSION STANDARDS AND TEST PROCEDURE 8

NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards, driving cycles – USA, Japan, Euro and India. Test procedures – ECE, FTP Tests. SHED Test – chassis dynamometers, dilution tunnels.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Paul Degobert – Automobiles and Pollution – SAE International ISBN-1-56091-563-3, 1991.
2. Ganesan, V- “Internal Combustion Engines”- Tata McGraw-Hill Co.- 2003.
3. Beranek.L.L. “ Noise Reduction”, McGraw Hill Book co., Inc, New York, 1993.

REFERENCES

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

LIST OF EXPERIMENTS

1. Study and layout of an automobile repair, service and maintenance shop.
2. Study and preparation of different statements/records required for the repair and maintenance works.
3. Cylinder reboring – checking the cylinder bore, Setting the tool and reboring.
4. Valve grinding, valve lapping - Setting the valve angle, grinding and lapping and checking for valve leakage
5. Calibration of fuel injection pump
6. Minor and major tune up of gasoline and diesel engines.
7. Study and checking of wheel alignment - testing of camber, caster.
8. Testing kingpin inclination, toe-in and toe-out
9. Brake adjustment and Brake bleeding.
10. Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.
11. Battery testing and maintenance.
12. **Practice the following:**
 1. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play
 2. Air bleeding from hydraulic brakes, air bleeding of diesel fuel system
 3. Wheel bearings tightening and adjustment
 4. Adjustment of head lights beam
 5. Removal and fitting of tyre and tube

TOTAL : 45 PERIODS

LIST OF EQUIPMENTS

(for a batch of 30 students)

- | | | |
|-----|--|--------------|
| 1. | Engine Analyzer | - 1 No. |
| 2. | Cylinder compression pressure gauge | - 1 No. |
| 3. | Vacuum gauge | - 1 No. |
| 4. | Spark plug cleaner and tester | - 1 No. |
| 5. | Cam angle and rpm tester | - 1 No. |
| 6. | Tachometer | - 1 No. |
| 7. | Wheel alignment apparatus | - 1 No. |
| 8. | Gas welding equipment | - 1 No. |
| 9. | Tyre remover | - 1 No. |
| 10. | Bearing puller | - 1 No. |
| 11. | Head light alignment gauge | - 1 No. |
| 12. | Service manuals of petrol, diesel engines | - 1 No: each |
| 13. | Cylinder reboring machine | - 1No. |
| 14. | Valve grinding machine | - 1 No. |
| 15. | Valve lapping machine | - 1 No. |
| 16. | Fuel injection calibration test bench with nozzle tester | - 1 No. |
| 17. | HRD tester, Clamp on meter, Hydrometer | -1 No: each |

OBJECTIVES

1. To be able to understand and handle design problems in a systematic manner.
2. To gain practical experience in handling 2D drafting and 3D modeling software systems.
3. To be able to apply CAD in real life applications.
4. To understand the concepts G and M codes and manual part programming.
5. To expose students to modern control systems (Fanuc, Siemens etc)
6. To know the application of various CNC machines
7. To expose students to modern CNC application machines EDM, EDM wire cut and Rapid Prototyping

3D Geometric Modeling

Creation of 3D Models - Wire Frame, Surface, Solid modeling Techniques Using CAD Packages – CSG, B-Rep Approaches in Solid Modeling - Feature Based Modeling Technique – Assembly – Detailing - Exposure to Industrial Components – Application of GD&T

STL File Generation – Reverse Engineering**Manual CNC Part Programming**

Manual CNC Part Programming Using Standard G and M Codes - Tool Path Simulation – Exposure to Various Standard Control Systems- Machining simple components by Using CNC machines.

Computer Aided Part Programming

CL Data Generation by Using CAM Software– Post Process Generation for Different Control System – Machining of Computer Generated Part Program by Using Machining Center and Turning Center.

Study of Experiments

Multi-axial Machining in CNC Machining Center –EDM – EDM Wire Cut - Rapid Prototyping

LIST OF EQUIPMENTS

(for a batch of 30 students)

I. HARDWARES

- | | | |
|----|---|---------|
| 1. | Computer server | 1 No. |
| 2. | Computer nodes or systems (Pentium IV with 256MB Ram) networked to the server | 15 Nos. |
| 3. | A3 size plotter | 2 Nos. |
| 4. | Laser Printer | 2 Nos. |
| 5. | Trainer CNC lathe | 2 Nos. |
| 6. | Trainer CNC milling | 2 Nos. |

II. SOFTWARES

- | | | |
|----|---|-------------|
| 1. | CAD/CAM Software
(Pro –E or IDEAS or Unigraphics or CATIA) | 15 licenses |
| 2. | CAM Software
(CNC programming and tool path simulation for FANUC, Sinumeric and Heiden controller) | 15 licenses |

OBJECTIVE

At the end of the course, the students will be able to have a sound knowledge for the design of the vehicles body to give maximum comfort for the passengers and exposed to the methods of stream lining the vehicles bodt to minimize drag.

UNIT I CAR BODY DETAILS 10

Types Saloon, convertibles, Limousine, Estate Van, racing and sports car – Visibility: regulations, driver's visibility, tests for visibility – Methods of improving visibility and space in cars – Safety: safety design, safety equipments for car. Car body construction.

UNIT II VEHICLE AERODYNAMICS 9

Objectives, Vehicle drag and types; various types of forces and moments, effects of forces and moments, side wind effects on forces and moments. Various body optimization techniques for minimum drag, wind tunnel testing; flow visualization techniques, scale model testing, component balance to measure forces and moments.

UNIT III BUS BODY DETAILS 9

Types: Mini bus, single decker, double decker, two level, split level and articulated bus – Bus body lay out – Constructional details: Types of metal sections used – Regulations – Conventional and integral type construction.

UNIT IV COMMERCIAL VEHICLE DETAILS 8

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

UNIT V BODY MATERIALS, TRIM AND MECHANISMS 9

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

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Powloski,J., Vehicle Body Engineering, Business Books Ltd., 1989.
2. John Fenton, Vehicle Body layout and analysis, Mechanical Engg. Publication Ltd., London, 1982.

REFERENCES

1. Giles,G.J., Body construction and design, Illiffe Books Butterworth & Co., 1971.
2. Braithwaite,J.B., Vehicle Body building and drawing, Heinemann Educational Books Ltd., London, 1977.
3. Dieler Anselm., The passenger car body, SAE International, 2000

AU 2452

COMPREHENSION
(Common to all branches)

L T P C
0 0 2 1

OBJECTIVE

The objective of comprehension is to provide opportunity for the student to apply the knowledge acquired during the earlier semesters to real life problems which he/she may have to face in future as an engineer. While learning as how to solve the real life problems, student will receive guidance from the faculty and also review various courses learnt earlier.

AU 2453

PROJECT WORK
(Common to all Branches)

L T P C
0 0 12 6

OBJECTIVES

- The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
- Each student shall finally produce a comprehensive report covering back round information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.
- The continuous assessment shall be made as prescribed by the Anna University regulations

GE2021

PROFESSIONAL ETHICS IN ENGINEERING

L T P C
3 0 0 3

UNIT I ENGINEERING ETHICS

9

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

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION

9

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

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY

9

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

UNIT IV RESPONSIBILITIES AND RIGHTS 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) - Discrimination

UNIT V GLOBAL ISSUES 9

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

TOTAL :45 PERIODS

TEXT BOOKS

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

REFERENCES

1. Charles D Fleddermann, “Engineering Ethics”, Prentice Hall, New Mexico, (1999).
2. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press, (2003)

AU 2021 AUTOMOTIVE AIR-CONDITIONING

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

OBJECTIVE

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

UNIT I AIRCONDITIONING FUNDAMENTALS 9

Basic air conditioning system - location of air conditioning components in a car, schematic layout of a refrigeration system, compressor components, condenser and high pressure service ports, thermostatic expansion valve, expansion valve calibration, controlling evaporator temperature, evaporator pressure regulator, evaporator temperature regulator.

UNIT II AIR CONDITIONER – HEATING SYSTEM 9

Automotive heaters, manually controlled air conditioner, heater system, automatically controlled air conditioner and heater systems, automatic temperature control, air conditioning protection, engine protection.

UNIT III REFRIGERANT 9

Containers handling refrigerants, tapping into the refrigerant container, refrigeration system diagnosis, diagnostic procedure, ambient conditions affecting system pressures.

UNIT IV AIR ROUTING AND TEMPERATURE CONTROL 9

Objectives, evaporator airflow through the recirculating unit, automatic temperature control, duct system, controlling flow, vacuum reserve, testing the air control and handling systems.

UNIT V AIR CONDITIONING SERVICE 9

Air conditioner maintenance and service, servicing heater system removing and replacing components, trouble shooting of air controlling system, compressor service.

TOTAL : 45 PERIODS

TEXT BOOKS

1. William H. Crouse and Donald I. Anglin - "Automotive Air conditioning" - McGraw Hill Inc. - 1990.
2. Boyce H.DWiggins - "Automotive Air Conditioning" - Delmar – 2002

REFERENCES

1. Mitchell information Services, Inc - "Mitchell Automatic Heating and Air Conditioning Systems" - Prentice Hall Ind. - 1989.
2. Paul Weiser - "Automotive Air Conditioning" - Reston Publishing Co., Inc., - 1990.
3. MacDonald, K.I., - "Automotive Air Conditioning" - Theodore Audel series - 1978
4. Goings.L.F. – "Automotive Air Conditioning" - American Technical services - 1974.

**AU 2022 ALTERNATE FUELS AND ENERGY SYSTEMS L T P C
3 0 0 3**

OBJECTIVE

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

UNIT I INTRODUCTION 9

Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternate energy sources. Like EV, hybrid, fuel cell and solar cars.

UNIT II ALCOHOLS 9

Properties as engine fuel, alcohols and gasoline blends, performance in SI engine, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI & CI Engines.

UNIT III NATURAL GAS, LPG, HYDROGEN AND BIOGAS 9

Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG using LPG in SI & CI engines, performance and emission of LPG. Hydrogen; storage and handling, performance and safety aspects.

UNIT IV VEGETABLE OILS 9
Various vegetable oils for engines, esterification, performance in engines, performance and emission characteristics, bio diesel and its characteristics

UNIT V ELECTRIC, HYBRID, FUEL CELL AND SOLAR CARS 9
Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar powered vehicles.

TOTAL : 45 PERIODS

TEXT BOOK

1. Richard.L.Bechfold – Alternative Fuels Guide Book - SAE International Warrendale - 1997.
2. Maheswar Dayal - "Energy today & tomorrow" - I & B Horishr India - 1982.

REFERENCES

1. Nagpal - "Power Plant Engineering" - Khanna Publishers - 1991.
2. "Alcohols as motor fuels progress in technology" - Series No.19 - SAE Publication USE - 1980.
3. SAE paper nos. 840367, 841333, 841334, 841156, Transactions, SAE, USA.

AU 2023 VIBRATION, NOISE AND HARSHNESS CONTROL L T P C
3 0 0 3

OBJECTIVE

- The students will be able to understand the sources of vibration, noise and harshness in automobiles and make design modifications to reduce them and improve the life of the components and the comfort of the passengers

UNIT I BASICS OF VIBRATION 10
Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

UNIT II VIBRATION CONTROL TECHNIQUES 10
Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers

UNIT III BASICS OF NOISE AND SOURCES 10
Introduction, , noise dose level, legislation, measurement and analysis of noise in engines, Noise characteristics, overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

UNITIV NOISE CONTROL 9
Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

UNIT V HARSHNESS AND ITS CONTROL**6**

Harshness, sources, its effects, measurement and control

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Singiresu S.Rao - "Mechanical Vibrations" - Pearson Education, ISBN –81-297-0179-0 - 2004.
2. Rao V. Dukkipati and J.Srinivas, "Text book of Mechanical Vibrations", Prentice-Hall of India P Ltd, New Delhi, 2004
3. Kewal Pujara "Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.

REFERENCES

1. Bernard Challen and Rodica Baranescu - "Diesel Engine Reference Book" - Second edition - SAE International - ISBN 0-7680-0403-9 – 1999.
2. Julian Happian-Smith - "An Introduction to Modern Vehicle Design"- Butterworth-Heinemann, ISBN 0750-5044-3 - 2004
3. John Fenton - "Handbook of Automotive body Construction and Design Analysis - Professional Engineering Publishing, ISBN 1-86058-073- 1998.

AU 2024**ADVANCED THEORY OF I.C ENGINES****L T P C****3 0 0 3****OBJECTIVE**

- To explain the theory of combustion processes in SI and CI engines and the gas exchange processes and the various possible alternate fuels and the developments in the recent years in this area.

UNIT I COMBUSTION IN SI ENGINES**9**

Stages of combustion - ignition, flame propagation, factors affecting flame structure and speed, cycle by cycle variations, misfire, knock and pre-ignition. Factors controlling combustion chamber design. Combustion in diesel engines, comparison of different combustion systems, fuel spray structure and factors affecting it. Models for combustion in SI and CI engines.

UNIT II GAS EXCHANGE PROCESSES**9**

Gas exchange processes in two and four stroke engines, factors affecting volumetric efficiency, flow through valves and ports, multi valve concept. Charge motion within the cylinder. Turbocharging and Turbocharger control. Different methods of charging and scavenging two stroke engines.

UNIT III COMBUSTION ANALYSIS**9**

Introduction to HWA, LDA and PIV systems to analyse engine flows. Engine heat transfer and energy balance, correlations for heat transfer coefficient, variables affecting heat transfer in engines. Cylinder pressure data acquisition and thermodynamic analysis of engine pressure data to yield heat release rates.

UNIT IV ALTERNATIVE FUELS**9**

Alternative gaseous and liquid fuels for SI and CI engines, Alcohols, Biogas, LPG, CNG, Hydrogen, Biodiesel and Straight Vegetable oils, their properties and characteristics when used as engine fuels. Production, storage and distribution of different alternative fuels.

UNIT V RECENT DEVELOPMENTS 9
Homogeneous charge compression ignition, Stratified charge and gasoline direct injection, Dual fuel, lean burn and Hot surface Ignition engine concepts. Hybrid Electric Drives.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Internal Combustion Engines by V. Ganesan, 2007, Tata Mc Graw Hill
2. Internal Combustion Engine Fundamentals, John B Heywood, Mc Graw Hill
3. Advanced Engine Technology by Heisler, SAE Publication

REFERENCES

1. Internal Combustion Engines by Richard Stone, Macmillan Book Company also SAE Publications
2. Internal Combustion Engines by Colin R Ferguson, John Wiley and Sons
3. Design and Simulation of Two Stroke Engines, GP Blair SAE Publications

ME2021 QUALITY CONTROL AND RELIABILITY ENGINEERING L T P C
3 0 0 3

(Common to Mechanical, Automobile and Production- VI semester core)

OBJECTIVES

- To introduce the concept of SQC
- To understand process control and acceptance sampling procedure and their application.
- To learn the concept of reliability.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 10
Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process-causes of variation – Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and σ chart -process capability – process capability studies and simple problems. Six sigma concepts.

UNIT II PROCESS CONTROL FOR ATTRIBUTES 8
Control chart for attributes – control chart for non conformings– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III ACCEPTANCE SAMPLING 9
Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV LIFE TESTING - RELIABILITY 9
Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

UNIT IV TEMPERATURE MEASUREMENT: 9

Temperature scales – mechanical temperature sensors, liquid in glass, vapour pressure, bimetal temperature gauges. Resistance type temperature sensors. Thermistors, thermocouples, Laws of thermocouple, types of thermocouples. Construction and circuits for thermocouples. High temperature measurement pyrometers.

UNIT V FORCE AND TORQUE MEASUREMENT: 9

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

TOTAL: 45 PERIODS

TEXT BOOKS

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

REFERENCES

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

**AU 2026 SUPERCHARGING AND SCAVENGING L T P C
3 0 0 3**

OBJECTIVE

- To make the students understand the need for supercharging and the various types of superchargers used and their performance characteristics and the scavenging methods for two stroke engines. These concepts and principles are familiarized for design of components.

UNIT I SUPERCHARGING 8

Effects on engine performance – engine modification required Thermodynamics of Mechanical Supercharging and Turbocharging – Turbocharging methods – Engine exhaust manifolds arrangements.

UNIT II SUPERCHARGERS 10

Types of compressors – Positive displacement blowers – Centrifugal compressors – Performance characteristic curves – Suitability for engine application – Surging – Matching of supercharger compressor and Engine – Matching of compressor, Turbine, Engine.

UNIT III	SCAVENGING OF TWO STROKE ENGINES	12
Peculiarities of two stroke cycle engines – Classification of scavenging systems – Mixture control through Reed valve induction – Charging Processes in two stroke cycle engine – Terminologies – Shankey diagram – Relation between scavenging terms – scavenging modeling – Perfect displacement, Perfect mixing – Complex scavenging models.		
UNIT IV	PORTS AND MUFFLER DESIGN	8
Porting – Design considerations – Design of Intake and Exhaust Systems – Tuning.		
UNIT V	EXPERIMENTAL METHODS	7
Experimental techniques for evaluating scavenging – Firing engine tests – Non firing engine tests – Port flow characteristics – Kadenacy system – Orbital engine combustion system.		

TOTAL : 45 PERIODS

TEXT BOOKS

1. Watson, N. and Janota, M.S., Turbocharging the I.C.Engine, MacMillan Co., 1982.
2. John B.Heywood, Two Stroke Cycle Engine, SAE Publications, 1997.

REFERENCES

1. Obert, E.F.,Internal Combustion Engines and Air Pollution, Intext Educational
2. Publishers, 1980.
3. Richard Stone, Internal Combustion Engines, SAE, 1992.
4. Vincent,E.T., Supercharging the I.C.Engines, McGraw-Hill. 1943
5. Schweitzer, P.H., Scavenging of Two Stroke Cycle Diesel Engine, MacMillan Co., 1956

AU 2027	AUTOMOTIVE AERODYNAMICS	L T P C
		3 0 0 3

OBJECTIVE

- To make the students understand the design concept of automobile bodies and to determine their drag coefficients and optimize their shapes.The use of wind tunnel for the same will be illustrated.

UNIT I	INTRODUCTION	9
Scope – historical development trends – Fundamentals of fluid mechanics – Flow phenomenon related to vehicles – External & Internal flow problems.. – Resistance to vehicle motion – Performance – Fuel consumption and performance – Potential of vehicle aerodynamics.		
UNIT II	AERODYNAMIC DRAG OF CABS	9
Car as a bluff body – Flow field around car – drag force – types of drag force – analysis of aerodynamic drag – drag coefficient of cars – strategies for aerodynamic development – low drag profiles.		
UNIT III	SHAPE OPTIMIZATION OF CABS	9
Front and modification – front and rear wind shield angle – Boat tailing – Hatch back, fast back and square back – Dust flow patterns at the rear – Effect of gap configuration – effect of fasteners.		

UNIT III LAMINA STRENGTH ANALYSIS 5

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

UNIT IV THERMAL ANALYSIS 8

Assumption of Constant C.T.E's. Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

UNIT V ANALYSIS OF LAMINATED FLAT PLATES 10

Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

TOTAL: 45 PERIODS

TEXT BOOK

1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994, Second Edition - CRC press in progress.
2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw-Hill, 1998

REFERENCES

1. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press-2006, First Indian Edition - 2007
2. Mallick, P.K., Fiber –"Reinforced Composites: Materials, Manufacturing and Design", Maneeel Dekker Inc, 1993.
3. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co., 1984.
4. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
5. Mallick, P.K. and Newman, S., (edition), "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munish, 1990.

**ME 2029 DESIGN OF JIGS, FIXTURES & PRESS TOOLS L T P C
3 0 0 3**

OBJECTIVES

- To understand the functions and design principles of Jigs, fixtures and press tools
- To gain proficiency in the development of required views of the final design.

UNIT I LOCATING AND CLAMPING PRINCIPLES 8

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

UNIT II JIGS AND FIXTURES**10**

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES**10**

Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

UNIT IV BENDING FORMING AND DRAWING DIES**10**

Difference between bending, forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing reverse re-drawing and combination dies – Blank development for ax- symmetric, rectangular and elliptic parts – Single and double action dies.

UNIT V MISCELLANEOUS TOPICS**7**

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke - Course should be supplemented with visits to industries.
(Use of Approved design Data Book permitted).

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Joshi, P.H. “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.
2. Donaldson, Lecain and Goold “Tool Design”, III rd Edition Tata McGraw Hill, 2000.

REFERENCES

1. K. Venkataraman, “Design of Jigs Fixtures & Press Tools”, Tata McGraw Hill, New Delhi, 2005. Kempster, “Jigs and Fixture Design”, Hoddes and Stoughton – Third Edition 1974.
2. Joshi, P.H. “Press Tools” – Design and Construction”, Wheels publishing, 1996.
3. Hoffman “Jigs and Fixture Design” – Thomson Delmar Learning, Singapore, 2004.
4. ASTM Fundamentals of Tool Design Prentice Hall of India.
5. Design Data Hand Book, PSG College of Technology, Coimbatore.

OBJECTIVE

- To make the students understand the basic principles of simulation of the combustion processes in engines used for automobiles and the heat transfer mechanism and friction losses of the different systems.

UNIT I COMBUSTION CALCULATIONS 12

Heat of reaction at constant volume and constant pressure, Calculation of properties of the working medium in an engine, Constant volume and constant pressure adiabatic combustion, Calculation of Adiabatic flame temperature.

UNIT II SIMULATION OF SI ENGINE COMBUSTION 12

Engine kinematics, Ideal Otto cycle, SI engine simulation with adiabatic combustion with air as the working substance under full and part throttle conditions. Actual SI engine heat release rate curves. SI engine combustion models including Wiebe's function

UNIT III SIMULATION OF CI ENGINE COMBUSTION 12

CI engine simulation with adiabatic combustion with air as the working substance under naturally aspirated, supercharged and turbocharged conditions. Actual heat release rates of diesel engines, Hardenberg and Hase and other ignition delay models for diesel engines, Zero dimensional combustion models for CI engines – Watsons and White House and Way models.

UNIT IV GAS EXCHANGE PROCESSES 12

Flow through valves their characteristics, compressible and incompressible flow through valves, volumetric efficiency and Mach index, Effect of valve timing on volumetric efficiency, Swirl and squish, SI engine simulation with gas exchange, influence of valve timing and area. CI engine simulation with gas exchange.

UNIT V HEAT TRANSFER AND FRICTION IN ENGINES 12

Engine friction variation, models for engine friction, Heat transfer mechanisms in engines, Models for heat transfer in engines. Two stroke engine scavenging parameters like delivery ratio, scavenging efficiency, trapping efficiency. Perfect displacement and perfect mixing models for scavenging.

TOTAL: 45 PERIODS**TEXT BOOKS**

- Computer simulation of compression ignition engine processes by V. Ganesan, Universities Press, 2000.
- Computer simulation of Spark Ignition Engine Processes by V Ganesan, Universities Press, 2000
- Introduction to Internal Combustion Engines by Richard Stone:

REFERENCES

- Internal Combustion Engines – Applied Thermo Sciences, Colin R Ferguson, John Wiley and Sons.
- Internal Combustion Engine Fundamentals, John B Heywood, Mc Graw Hill

(Common to Mechanical, Automobile and Production - core)

OBJECTIVES

- To understand the basic concepts associated with the design and functioning and applications of Robots
- To study about the drives and sensors used in Robots
- To learn about analyzing robot kinematics and robot programming

UNIT I FUNDAMENTALS OF ROBOT 7

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Functions – Need for Robots – Different Applications

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 10

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of Drives End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

UNIT III SENSORS AND MACHINE VISION 10

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction: Edge detection, Feature Extraction and Object Recognition - Algorithms. Applications – Inspection, Identification, Visual Servicing and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 10

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 8

RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

TOTAL : 45 PERIODS

TEXT BOOK

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

REFERENCES

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

AU2029

NEW GENERATION AND HYBRID VEHICLES

L T P C
3 0 0 3

OBJECTIVE

- To illustrate the new generation vehicles and their operation and controls

UNIT I INTRODUCTION 7

Electric and hybrid vehicles, flexible fuel vehicles (FFV), solar powered vehicles, magnetic track vehicles, fuel cells vehicles.

UNIT II POWER SYSTRM AND NEW GENERATION VEHICLES 12

Hybrid Vehicle engines, Stratified charge engines, learn burn engines, low heat rejection engines, hydrogen engines, HCCI engine, VCR engine, surface ignition engines, VVTI engines. High energy and power density batteries, fuel cells, solar panels, flexible fuel systems.

UNIT III VEHICLE OPERATION AND CONTROL 9

Computer Control for pollution and noise control and for fuel economy - Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

UNIT IV VEHICLE AUTOMATED TRACKS 9

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, GPS.

UNIT V SUSPENSION, BRAKES, AERODYNAMICS AND SAFETY 8

Air suspension – Closed loop suspension, compensated suspension, anti skid braking system, retarders, regenerative braking, safety gauge air backs- crash resistance. Aerodynamics for modern vehicles, safety systems, materials and standards.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Modern Vehicle Technology by Heinz.
2. Bosch Hand Book, SAE Publication,, 2000

REFERENCES

1. Light weight electric for hybrid vehicle design.
2. Advance hybrid vehicle power transmission, SAE.
3. Noise reduction, Branek L.L., McGraw Hill Book company, New York, 1993.

OBJECTIVE

- At the end of the course, the students will be able to understand the various Off road vehiclea and their systems and featuresa

UNIT I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES 6

Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multiaxle vehicles.

UNIT II EARTH MOVING MACHINES 10

Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, excavators, backhoe loaders, scrappers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.

UNIT III SCRAPPERS ,GRADERS, SHOVELS AND DITCHERS 10

Scrappers, elevating graders, motor graders, self powered scrappers and graders, Power shovel, revolving and stripper shovels – drag lines – ditchers – capacity of shovels.

UNIT IV FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES 8

Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.

UNIT V VEHICLE SYSTEMS ,FEATURES 11

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

TOTAL: 45 PERIODS

TEXT BOOKS

1. Robert L Peurifoy, "Construction, planning, equipment and methods" Tata McGrawel Hill Publishing company Ltd.
2. Nakra C.P., "Farm machines and equipments" Dhanparai Publishing company Pvt. Ltd.
3. Abrosimov.K. Bran berg.A and Katayer.K., Road making machinery, MIR Publishers, Moscow, 1971.
4. SAE Handboob Vol. III.
5. Wong.J.T., "Theory of Ground Vehicles", John Wiley & Sons, New York, 1987.

REFERENCES

1. Off the road wheeled and combined traction devices – Ashgate Publishing Co. Ltd. 1988.
2. Schulz Erich.J, Diesel equipment I & II, Mcgraw Hill company, London.
3. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co Ltd., London.
4. Satyanarayana. B., Construction planning and equipment, standard publishers and distributors, New Delhi.

OBJECTIVE

- To enable the students understand the concept of project and materials management and illustrate the various systems and procedures involved

UNIT I PROJECT MANAGEMENT 12

Concept of project-Categories of projects-Project life cycle - Concept of project management -Tools and techniques for project management-The project manager-Roles and responsibilities of project manager- Project formulation-Formulation of stages-Bottlenecks-Feasibility Report-Financing arrangements-Finalization of project-Implementation of project..

UNIT II PROJECT EXECUTION AND CONTRACT 12

Administrative agencies for project approval- Ministry of finance- Bureau of public enterprises –Planning commission- Public Investment Board. Organizing human resources and contracting-Delegation of project manager's authority-Project organization-Accountability in project execution-Contracts- 'R' of contracting-Tendering and selection of contractors-Team building

UNIT III SYSTEMS AND PROCEDURES 12

Organizing and working of systems-Design of systems-Project work system design- work breakdown structure-project execution plan-project procedure-manual project control system- planning , scheduling , monitoring and controlling-monitoring contracts and project diary.

Project implementation-stages of project direction- communication in a project-coordination guidelines for effective implementation-Reporting in project management-project evaluation and its objectives, types, and methods.

UNIT IV MATERIAL MANAGEMENT 12

Concept and importance of Material Management-organization of Material management- purchase methods-Dynamic purchasing-Purchasing decisions (quality, quantity, suppliers, time, price) - Purchasing function-Selection of Materials and vendors-purchasing organization-concept of value analysis-import substitution-vendor rating-vendor development.

UNIT V INVENTORY MANAGEMENT 12

Material requirement planning , forecasting and Inventory management-inventory control- factors affecting inventory control policy –Inventory costs, Basic EOQ model-Re-order level-ABC analysis-statistical methods in inventory control-inventory classification methods.

Store keeping and warehouse management-objectives-functions-store keeper-duties-responsibilities-location of store-stores ledger.Cost control& cost reduction programmes.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. B.B. Goel-Project Management-Deep and Deep Publications, New Delhi,2004
2. Choudhury-S. Project Management –TaTa Mc Graw –Hill- Publishing Company Limited, New Delhi,2005
3. Datta.A.K. Integrated Material Management
4. Gopalakrishnan.P. and Sthuram. M. Material management-An integral Approach
5. M.V.Varma –Material Management

REFERENCES

1. Mattin.C.C. Project Management-American Management Association, New York,1976.
2. Denis Lock-Project Management-Coles Publishing company,1980

AU 2032

ENGINE AUXILLARY SYSTEMS

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

OBJECTIVE

- To make the students understand the various auxiliary systems used in automobiles and their functions

UNIT I CARBURETION 10

Properties of air-petrol mixtures, Mixture requirements for steady state and transient operation, Mixture formation studies of volatile fuels, design of elementary carburetor, Chokes, Effects of altitude on carburetion, Carburetor for 2-stroke and 4-stroke engines, carburetor systems for emission control.

UNIT II GASOLINE INJECTION AND IGNITION SYSTEMS 9

Petrol Injection, Pneumatic and Electronic Fuel Injection Systems types. Ignition system requirements, Timing, Ignition Systems, breaker mechanism and spark plugs, Factors affecting energy requirement of the ignition system, factors affecting spark plug operation, Electronic Ignition Systems.

UNIT III DIESEL FUEL INJECTION 9

Factors influencing fuel spray atomization, penetration and dispersion of diesel and heavy oils and their properties, rate and duration of injection, fuel line hydraulics, fuel pump, injectors, CRDI systems and its merits and demerits.

UNIT IV MANIFOLDS AND MIXTURE DISTRIBUTION 9

Intake system components, Discharge coefficient, Pressure drop, Air filter, Intake manifold, Connecting pipe, Exhaust system components, Exhaust manifold and exhaust pipe, Spark arresters, Waste heat recovery, Exhaust mufflers, Type of mufflers, exhaust manifold expansion.

UNIT V LUBRICATION AND COOLING SYSTEMS 8

Lubricants, lubricating systems, Lubrication of piston rings, bearings, oil consumption, Oil cooling. Heat transfer coefficients, liquid and air cooled engines, coolants, additives and lubricity improvers, concept of adiabatic engines.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Ramalingam,K.K, Internal Combustion Engine, Scitech Publication (India)
2. Ganesan, V., Internal Combustion Engines, Tata McGraw-Hill Book Co., 1995.

REFERENCES

1. Domkundwar, V.M, A Course in Internal Combustion Engines, Dhanpat Rai and Co., 1999.
2. Mathur, M.L., and Sharma, R.P., A Course in Internal Combustion Engines, Dhanpat Rai Publications (P) Ltd., 1998.
3. Duffy Smith, Auto Fuel Systems, The Good Heart Willcox Company Inc., Publishers, 1987.
4. Edward F, Obert, Internal Combustion Engines and Air Pollution, Intext Education Publishers, 1980.

MG 2021

MARKETING MANAGEMENT

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

(Common to Mechanical, Production and Mechatronics)

OBJECTIVES

- To understand the various processes involved in Marketing and its Philosophy.
- To learn the Psychology of consumers.
- To formulate strategies for advertising, pricing and selling

UNIT I MARKETING PROCESS 9

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Govindarajan. M, "Marketing management – concepts, cases, challenges and trends", Prentice hall of India, second edition 2007.
2. Philip Kotler, Koshy Jha "Marketing Management", Pearson Education, Indian adapted edition. 2007

REFERENCES

1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context", 1990.
2. Czinkota & Kotabe, "Marketing management", Thomson learning, Indian edition 2007

REFERENCES

1. Hisrich R D and Peters M P, "Entrepreneurship" 5th Edition Tata McGraw-Hill, 2002.
2. Mathew J Manimala," Enterprenuership theory at cross roads: paradigms and praxis" Dream tech 2nd edition 2006.
3. Rabindra N. Kanungo "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
4. EDII " Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development" Institute of India, Ahmadabad, 1986.

AU2033

AUTOMOTIVE SAFETY

L T P C
3 0 0 3

OBJECTIVE

- At the end, the students will have good exposure to automotive safety aspects including the understanding of the various safety equipments.

UNIT I INTRODUCTION

9

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

UNIT II SAFETY CONCEPTS

9

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

UNIT III SAFETY EQUIPMENTS

9

Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety.

UNIT IV COLLISION WARNING AND AVOIDANCE

9

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

UNIT V COMFORT AND CONVENIENCE SYSTEM

9

Steering and mirror adjustment, central locking system , Garage door opening system, tyre pressure control system, rain sensor system, environment information system

TOTAL: 45 PERIODS

TEXT BOOKS

1. Bosch - "Automotive Handbook" - 5th edition - SAE publication - 2000.
2. J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.

REFERENCE

1. Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., - 1999.

OBJECTIVE

- To introduce the concept of fuel cells for use in automobiles, analyse the performance characteristics of the various components and compare them with the other powering devices

UNIT I INTRODUCTION TO FUEL CELLS 9

Introduction – working and types of fuel cell – low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells – thermodynamics and electrochemical kinetics of fuel cells.

UNIT II FUEL CELLS FOR AUTOMOTIVE APPLICATIONS 9

Fuel cells for automotive applications – technology advances in fuel cell vehicle systems – onboard hydrogen storage – liquid hydrogen and compressed hydrogen – metal hydrides, fuel cell control system – alkaline fuel cell – road map to market.

UNIT III FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE 9

Fuel cell performance characteristics – current/voltage, voltage efficiency and power density, ohmic resistance, kinetic performance, mass transfer effects – membrane electrode assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates.

UNIT IV FUELING 9

Hydrogen storage technology – pressure cylinders, liquid hydrogen, metal hydrides, carbon fibers – reformer technology – steam reforming, partial oxidation, auto thermal reforming – CO removal, fuel cell technology based on removal like bio-mass.

UNIT V FUEL CYCLE ANALYSIS 9

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

TOTAL : 45 PERIODS

TEXT BOOKS

- Fuel Cells for automotive applications – professional engineering publishing UK. ISBN 1-86058 4233, 2004.
- Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press ISBN 0-8493-0877-1-2003.

(Common to Mechanical, Metallurgy, Automobile and Mechatronics – VI semester Elective)

OBJECTIVES

- To create awareness about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations.

UNIT I LINEAR MODEL 10

The phases of OR study – formation of an L.P model- graphical solution – simplex algorithm – artificial variables technique– Big M method, two phase method, Duality in LPP. Transportation problems- VAM – MODI technique, Assignment problems.

UNIT II NETWORK MODELS 8

Shortest route – minimal spanning tree - maximum flow models – project network- CPM and PERT network-critical path scheduling.

UNIT III INVENTORY MODEL 9

Types of Inventory- EOQ –ERL- Deterministic inventory problems – Price breaks - Stochastic inventory problems- selective inventory control techniques.

UNIT IV REPLACEMENT MODELS 9

Replacement of items that deteriorate with time – value of money changing with time –not changing with time – optimum replacement policy – individual and group replacement. Sequencing problem: models with n jobs with 2 machines – problem with n jobs with m machines.

UNIT V QUEUING THEORY 9

Queuing models – queuing systems and structures – notation –parameter – single server and multiserver models – Poisson input – exponential service – constant rate service – infinite population.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Wayne.L.Winston, Operations research applications and algorithms, Thomson learning, 4th edition 2007.
2. Taha H.A, "Operation Research", Pearson Education sixth edition, 2003

REFERENCES

1. Frederick.S.Hiller and Gerald.J.Lieberman, "Operations research concepts and cases", TMH (SIE) 8th edition.
2. J.K.Sharma, "Operations research theory and applications", Macmillan India .3rd edition 2007,
3. Hira and Gupta " Problems in Operations Research", S.Chand and Co,2002.
4. Panneerselvam, "Operations Research" Prentice Hall of India, 2003.
5. G Srinivasan, "Operations research principles and applications", PHI (EEE) 2007.
6. Wagner, "Operations Research", Prentice Hall of India, 2000.

OBJECTIVE

- After completion of this course the students are able to manage a transport fleet and their related activities for minimizing operational cost.

UNIT I INTRODUCTION 9

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

UNIT II TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

UNIT III SCHEDULING AND FARE STRUCTURE 9

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

UNIT IV MOTOR VEHICLE ACT 9

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

UNIT V MAINTENANCE 9

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

TOTAL : 45 PERIODS**TEXTBOOKS**

1. John Duke - Fleet Management – McGraw-Hill Co, USA -1984.
2. Kitchin.L.D., - Bus Operation - Illiffee and Sons Co., London, III edition - 1992

REFERENCE

1. Government Motor Vehicle Act –Publication on latest act to be used as on date

UNIT I INTRODUCTION 9

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

UNIT II TQM PRINCIPLES 9

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

UNIT III TQM TOOLS & TECHNIQUES I 9

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

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS 9

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. Dale H.Besterfield, et al., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).
2. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.

REFERENCES

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