



ANNA UNIVERSITY
Chennai-25.
Syllabus for

B.E.(Full Time) Automobile Engineering

AT331 Engineering Design

3 0 0 100

1. INTRODUCTION 15

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

2. LIMITS, FITS AND SURFACE FINISH 6

Definitions - Types of tolerances - Geometrical tolerances - Types of fits - Design consideration of interference fits - Surface finish - Surface roughness - Design of power transmission shafts - Design of closely coiled helical springs

3. GEAR DESIGN 8

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

4. FLYWHEELS 7

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

5. DESIGN OF BEARINGS 9

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

Total No of periods: 45

References:

1. Jain. R.K. "*Machine Design* ", Khanna Publishers, 1992.
2. Sundararaja Murthy.T.V. "*Machine Design* ", Khanna Publishers, New Delhi, 1991.
3. Hall Allen.S & Others, "*Machine Design* ", Schaum Publisher Co.. 1982.
4. Shigley, "*Machine Design* " McGraw Hill, 1981.
5. *Design Data Book*, PSG College of Technology, Coimbatore, 1992.
6. Bhandari.V.B. "*Design of Machine elements* ", Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1990.
7. George E.Dieter, "*Engineering Design*", Mc Graw Hill, 1987.

1. BATTERIES 9

Principle and construction of lead-acid battery. Characteristics of battery rating Capacity and efficiency of batteries. Various tests on battery condition charging methods.

2. STARTING SYSTEM 9

Condition at Starting Behaviour of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units, care & maintenance of starter motor. Starter switches.

3. CHARGING SYSTEM 9

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 rectifiers.

4. IGNITION SYSTEM 9

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

5. LIGHTING SYSTEM & ACCESSORIES 9

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

Total No of periods: 45

References:

1. Judge. A.W., " *Modern Electrical Equipment of Automoblies* ", Chapman & Hall, London, 1992.
2. Young. A.P., & Griffiths.L., " *Automobile Electrical Equipment* ", English Languages 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.

1. DIESEL ENGINE BASIC THEORY 10

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

2. FUEL INJECTION SYSTEM 8

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 - Nozzle tests - Spray characteristics - Injection timing - Pump calibration.

3. AIR MOTION AND COMBUSTION CHAMBERS 12

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 & SI engines. Direct and indirect injection combustion chambers - Air cell chamber - Combustion chamber design objectives - Different types of combustion chamber - M-Combustion chamber.

4. SUPERCHARGING AND TURBOCHARGING 7

Necessity and limitation - Charge cooling - Types of Supercharging and turbocharging - Relative merits - Matching of turbocharger.

5. DIESEL ENGINE TESTING AND PERFORMANCE 8

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

Total No of periods: 45

Text Book:

1. *Ganesan.V., " Internal Combustion Engines ", Tata-McGraw Hill Publishing Co., New Delhi 1994.*
2. *Dr.K.K.Ramalingam "Internal Combustion Engines Theory and Practice", Scitech Publications(India) Pvt.Ltd, Chennai-17, 2001.*

References:

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

1. ELASTIC AND PLASTIC BEHAVIOUR OF MATERIALS 8

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

2. FRACTURE, FATIGUE AND CREEP 11

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, creep mechanism, metallurgical variables of creep.

3. CHARACTERISTICS OF MATERIALS 8

Castability, machinability, formability and weldability of engineering materials such as steel, cast iron, alloy steels, brass, bronze and Al alloys. Composite materials fabrication techniques, materials for high temperature. Cryogenic wear, corrosion, fatigue, creep and oxidation resistance application.

4. SELECTION OF MATERIALS 8

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.

5. HEAT TREATMENT AND SURFACE TREATMENT 10

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

Total No of periods: 45

References:

1. *Khanna.O.P., " Material Science and Metallurgy ", Dhanapal 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, MaGraw Hill, New York., 1982.*
5. *Raghavan.V., Physical Metallurgy, Principle and Practice, Prentice Hall, 1995.*
6. *Bawa.H.S., Materials Metallurgy, McGraw-Hill, 1996.*
7. *Avner S.H". Introduction to Physical Metallurgy" McGraw-Hill, New York, 1982.*
8. *Dieter, G.E., Mechanical Metallurgy, McGraw-Hill, New York, 1996.*

1. CLUTCH AND GEAR BOX 13

Requirement of transmission system. Different types of clutch, principle, Construction, torque capacity and design aspects. Determination of gear ratios for vehicles. Performance characteristics in different speeds. Different types of gear boxes, Conventional gear boxes.

2. HYDRODYNAMIC DRIVE 14

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

3. AUTOMOTIVE TRANSMISSION 13

Ford - T-model gear box, Wilson Gear box, Cotal electromagnetic transmission, Automatic over drive, Hydraulic control system for automatic transmission.

4. HYDROSTATIC DRIVE AND ELECTRIC DRIVE 13

Hydrostatic drive - Various types of hydrostatic systems - Principles of hydrostatic drive system, Advantage and limitations, Comparison of hydrostatic drive with hydrodynamic drive - Construction and working of typical Janny hydrostatic drive. Electric drive Principle of early and modified Ward Leonard Control system. Advantage & limitations. Performance characteristics.

5. AUTOMATIC TRANSMISSION APPLICATIONS 7

Chevrolet "Turboglide" Transmission, Powerglide Transmission Toyota "ECT-i" Automatic Transmission with Intelligent Electronic control system, Clutch Hydraulic Actuation system.

Total No of periods: 60

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., D.L., " *Automotive Transmission and Power Trains construction* ", McGraw-Hill, 1976.

1. LINEAR AND ANGULAR MEASUREMENTS 9

Errors in measurement & calibration - Length standards - Length measuring instruments - Vernier, micrometers, dial gauges, comparators, Limits, fits, tolerances. Gauges and their types - Angular measuring instruments - bevel protractor, spirit level, sine bar - measurement of straightness and flatness - Measurement of surface finish.

2. MEASUREMENT OF SCREW THREAD AND GEAR 9

Various elements of thread - Two wire & three wire method - thread gauge - Various elements of gears - Various gear tooth measurement methods, composite error measurement.

3. PRESSURE & FLOW MEASUREMENT 11

Diaphragm - various elastic elements - Transduction methods - Potentiometric strain gauge, variable reluctance and capacitive device, LVDT type transducer, piezo electric transducers and its application to high speed engine. Farnboro Engine indicator. Low pressure measurement - McLeod gauge, pirani gauge, thermocouple type conductivity gauge.

Classification of flow meters - Orifice plate, venturimeter, flow nozzles, pitot tubes, rotameter, electromagnetic flow meters, anemometers, ultrasonic and magnetic flow meters, alcohol viscous flow meter.

4. TEMPERATURE MEASUREMENT 8

Temperature scales - Mechanical temperature sensors - liquid in glass, vapour pressure, bimetal - resistance type temperature sensors and their measuring circuits - Thermistors, thermocouples, laws, types, construction, circuits - Radiation methods - Optical pyrometer

5. LOAD AND TORQUE MEASUREMENT 8

Force measuring devices, balances, platform scale weigh bridges, load cells. Torque measurement, prony brake, rope brake. Dynamometers. Electric cradle dynamometer, Eddy current dynamometers. Hydraulic dynamometer, Transmission and chassis dynamometer.

Total No of periods: 45

Text Books:

1. Jain.R.K., " *Engineering Metrology* " Khanna Publishers, New Delhi, 1994.
2. Rangan.C.S., Sarma.G.E. and Mani.V.S.V., " *Instrumentation Devices and Systems* " Tata McGraw Hill Publishing Co., New Delhi, 1990.

References:

1. Patranabis.D., " *Principles of Industrial Instrumentation* ", Tata McGraw Hill Publishing Co., New Delhi, 1996.
2. Beckwith.T.G. & Buck.N.L., " *Mechanical Measurements* ", Oxford and IBH Publishing House, New Delhi, 1990.
3. Jain.R.K., " *Mechanical & Industrial Measurements* ", Khanna Publishers, New Delhi, 1990.
4. Gaylor.F.W. and Shotbolt.C.R., " *Metrology for Engineers* ", ELBS Edition, 1990.
5. Khare and Vajpayee, " *Dimensional Metrology* ", Oxford IBH Publishing Co, New Delhi, 1990.

1. PERFORMANCE CURVES 15

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

2. EXPECTANCY CURVES 45

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

Total No of periods: 60

Text Book:

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

References:

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

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

3. Giri.N.K., " Automoble Mechanics ", Khanna Publishers, New Delhi, 1986.

AT338 Computer Aided Machine Drawing

0 0 3 100

1. DRAWING OF MACHINE ELEMENTS 30

Bolts - Nuts - Screw threads - Riveted joints - Couplings - Flanges - Bearings Assembly drawing Screw jack - Lathe tail stock - Hand drill - Machine vice - Valve actuators.

2. DRAWING OF ENGINE COMPONENTS 15

Piston - Piston pin - Piston rings - Connecting rod - Crank shaft.

Total No of periods: 45

1. Study of IC engine testing Dynamometers.
2. Study of 2 and 4 wheeler chassis Dynamometers.
3. Study of Pressure pickup, charge amplifier, storage oscilloscope and signal analysers used for IC engine testing.
4. Performance study of petrol engine at full throttle and part throttle conditions.
5. Performance study of diesel engine both at full load and part load conditions.
6. Morse test on petrol and diesel engines.
7. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in IC engines.
8. Heat balance test on a Automotive diesel engine.
9. Engine tuning for performance improvement.
10. Testing of 2 and 4 wheeler using chassis dynamometers.

Total No of periods: 45*Text Book:*

1. Giles.J.G., " Vehicle Operation and performance ", llyffe Books Ltd., London, 1989.

References:

1. Crouse.W.H. and Anglin.D.L., " Motor Vehicle Inspection " McGraw Hill Book Co., 1978.
2. Ganesan.V., " Internal Combustion engines ", Tata McGraw Hill Co., 1994.
3. BIS Code Books. IS-10000 series, 1988.

1. FUNDAMENTAL OF AUTOMOTIVE ELECTRONICS 5

Current trends in modern Automobilies, Open loop and closed loop systems - Components for electronic engine management. Electronic management of chassis system - Vehicle motion control.

2. SENSORS AND ACTUATORS 6

Introduction, 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, relays.

3. ELECTRONIC FUEL INJECTION AND IGNITION SYSTEMS 15

Introduction, Feed back carburettor systems (FBC) 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, Contactless electronic ignition system, Electronic spark timing control.

4. DIGITAL ENGINE CONTROL SYSTEM 10

Open loop and closed loop control systems - Engine cranking and warm up control - Acceleration enrichment - Deceleration leaning and idle speed control. Distributorless ignition - Integrated engine control system, Exhaust emission control engineering.

5. ELECTROMAGNETIC INTERFERENCE SUPPRESSION 9

Electromagnetic compatibility - Electronic dash board instruments - Onboard diagnosis system. security and warning system.

Total No of periods: 45

Text Books:

1. *William B.Riddens, " Understanding Automotive Electronics ", 5th Edition, Butterworth, Heinemann Woburn, 1998.*
2. *Tom Weather Jr and Cland C.Hunter, " Automotive Computers and Control System ". Prentice Hall Inc., New Jersey.*

References:

1. *Young. A.P. and Griffiths.L. " Automobile Electrical Equipment ", English Language Book Society and New Press.*
2. *Crouse. W.H., " Automobile Electrical equipment ", McGraw Hill Book Co Inc., New York, 1955.*
3. *Robert N Brady, " Automotive Computers and Digital Instrumentation ". A reston Book. Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.*
4. *Bechtold., " Understanding Automotive Electronic ", SAE, 1998.*
5. *T.Mellard, " Automotive Electronics ".*

1. 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 cars. Car body construction.

2. 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.

3. BUS BODY DETAILS 9

Types: Mini bus, single decker, double decker, two level, split level and articulated bus - Bus body lay out - Floor height - Engine location - Entracne and exit location - Seating dimensions - Constructional details: Frame construction, Double skin construction - Types of metal section used - Regulations - Conventional and integral type construction.

4. COMMERCIAL VEHICLE DETAILS 8

Types of body - Flat platform, drop side, fixed side, tipper body, tanker body - Light commercial vehicle body types - Dimensions of driver's seat relation to controls - Drivers cab design.

5. BODY MATERIALS, TRIM AND MECHANISMS 9

Steel sheet, timber, plastic, GRP, properties of materials - Corrosion - Anticorrosion methods - Scallation of paint and painting process - Body trim items - Body mechanisms.

Total No of periods: 45

Text Book:

1. Powloski.J., " Vehicle Body Engineering ", Business Books Ltd., 1989

References:

- 1. Giles.J.C. " Body construction and design ", Iiffe Books Butterworth & Co., 1971.*
- 2. John Fenton, " Vehicle Body layout and analysis ", Mechanical Engg Publication Ltd., London, 1982.*
- 3. Braithwaite.J.B., " Vehicle Body building and drawing ", Heinemann Educational Books Ltd., London, 1977.*

1. THEORY OF METAL CUTTING 8

Mechanism of cutting, chip formation and types, tool materials, tool geometry, cutting forces, cutting fluids, tool wear and life, machinability.

2. MACHINE TOOLS 10

Capston and Turret lathes, single spindle and multispindle automatics, milling machines, cylindrical and centreless grinding machines, broaching machines, boring and jig boring machines, NC, CNC and DNC machines.

3. ADVANCED WELDING PROCESS 8

Tungsten inert gas welding, metal inert gas welding, submerged arc welding, friction and electroslag welding, electron beam welding laser welding, ultrasonic welding, inspection of weldments.

4. CASTING 10

Sand casting and its process flow chart, permanent mould casting, pressure die casting, shell moulding, centrifugal casting, investment casting, CO₂ moulding process, fettling and cleaning of castings, defects in castings and remedies, inspection and testing of casting.

5. METAL FORMING 9

Hot, warm and cold forming - Forging, process flow chart, materials processes, equipments - Drawing and extrusion - Sheet metal forming - High velocity forming methods.

Total No of periods: 45

Text Book:

1. Jain.R.K. " *Production Technology* ", Khanna Publishers, New Delhi, 1996.

References:

1. Sharma.P.C., " *A Text book of production Engineering* ", S.Chand and Co., Ltd., 1996.
2. Martin.S.J., " *Numerical control of machine tools* ", The English language book society, London, 1980.
3. Richard.L.Little, " *Welding and Welding Technology* ", Tata McGraw Hill Co., New Delhi, 1985.
4. Lal.M. and Khanna.O.P., " *A Text Book of Foundry Technology* ", Dhanapet Rai & Sons, 1990.
5. " *High velocity forming of metals* ", ASTME, Prentice Hall of India P.Ltd., New Delhi, 1990.
6. Niebel. B.W., " *Modern Manufacturing Process Engineering* ", 1989.

1. THE POWER UNIT 9

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

2. CHASSIS AND SUB-SYSTEMS 8

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

3. BRAKES AND WHEELS 8

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

4. TWO WHEELERS 10

Case study of major Indian models of motor cycles, scooters and mopeds. Bajaj, Vespa, Lambretta Scooters. Enfield, TVS-suzuki, Hero Honda, Yamaha RX-100, Kawasaki Bajaj Motor cycles. Kinetic Spark, Hero Majestic, TVS Mopeds. Servicing and maintenance.

5. THREE WHEELERS 10

Case study of Indian models. Front engine and Rear engine. Auto rickshaws. Pick up van. Delivery van and Trailer.

Total No of periods: 45

Text Books:

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

References:

1. " *The Cycle Motor Manual* ", Temple PressLtd., London, 1990.

2. " *Encyclopedia of Motor cycling, 20 volumes* ", Marshall Cavensih,
New York and London, 1989.

3. Bryaut.R.V., " *Vespa Maintenance and Repair series* ".

4. Raymond Broad, Lambretta - " *A practical guide to maintenance and repair* ", 1987.

1. INTRODUCTION 5

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

2. SI ENGINE COMBUSTION AND POLLUTANT FORMATION 12

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

3. CI ENGINE COMBUSTION AND EMISSIONS 11

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

4. CONTROL TECHNIQUES FOR SI AND CI ENGINE EMISSION REDUCTION 9

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

5. TEST PROCEDURE & INSTRUMENTATION FOR EMISSION MEASUREMENT AND EMISSION STANDARDS 8

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

Total No of periods: 45

Text Books:

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

References:

- 1. Ganesan.V., " Internal Combustion Engines ", Tata McGraw Hill Co., 1994.*
- 2. SAE Transactions, " Vechicle emission ", 1982 (3 volums).*
- 3. Obert.E.F., " Internal Combustion Engines ", 1982.*
- 4. Taylor.C.F., " Internal Combustion Engines ", MIT Press, 1972.*
- 5. Heywood.J.B., " Internal Combustion Engine Fundamentals ", McGraw Hill Book Co., 1995.*
- 6. Automoblies and Pollution SAE Transaction, 1995.*

1. QUALITY CONTROL AND RELIABILITY ENGINEERING 8

Quality Concepts Quality - Factor influencing quality costs- Economics of quality quality assurance - statistical Tools used in quality in SQC - Quality planning - Organisation for quality, Bureau of Indian Standards - ISO 9000 - quality circles KAIZEN - TQM concepts - Quality audit.

2. STATISTICAL PROCESS CONTROL 10

Variation in processes - Factors - Process capability - Analysis of process capability - control charts - variables - Attributes - Establishing and interpreting control charts - X.R.charts for variables - defects - P charts. C-charts and U-charts-Control charts for Defective and quality rating.

3. ACCEPTANCE SAMPLING 10

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 - uses of standard sampling plans.

4. LIFE TESTING - RELIABILITY SYSTEMS APPROACH 10

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 .

5. QUALITY AND RELIABILITY 7

Reliability improvement - techniques - use of parato analysis - Design for reliability - Redundancy - standby redundancy - failsafe systems - optimazation in reliability - product Design - product Analysis Product Development product life cycle.

Total No of periods: 45

Text Books:

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).*

References:

1. *John Bank, " The Essence of Total Quality Management ", Prentice Hall of India P Ltd. New Delhi - 1995.*
2. *Danny Samson, " Manufacturing & Operations strategy ", Prentice Halls New York 1991.*
3. *Ganapathy K.Subramaniam B. Narayana " V-Quality Circle concepts and implementation " QCFI. Secondrabad 919940.*
4. *Tapan P. " Bagchi ISO9000. concepts methods and implementation ", Wheeler Publisher Allahabad 1994.*
5. *Conner P.D.T.O. " Practical Reliability Engineering ", John Wiley 1993.*
6. *Green A.E. and Bourne A.J. " Reliability, Technology ", Wiley Interscience 1991.*

1. Design of piston, piston pin and piston rings and drawing of these components.
2. Designing 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, development of short and long crankarms, front end and rear end details, drawing of the crankshaft assembly.
4. Design and drawing of flywheel, ring gear design, drawing of the flywheel including the development of ring gear teeth.
5. Design and drawing of the inlet and exhaust valves.
6. Computer aided design of the above components.
7. Design of Cam and Camshaft, Cam profile generation. Drawing of cam and camshaft.
8. Design of combustion chamber.
9. Design and drawing of engine complete assembly involved with cylinder block, cylinder head, crankcase, valve ports, water jackets, front and rear end details.

Total No of periods:

Text Books:

1. Heldt.P.M. " *High speed combustion engine* ", Chilton Books Co., 1952.

References:

1. Giles.J.G., " *Engine design* ", Iffiffe Books Ltd., London, 1962.
2. Newton.K. and Steeds.W., " *The Motor Vehicle, The English Language Book Society and Newnes Butterworth* ", London, 1972.
3. Khovak, " *Motor vehicle engines* ", MIR Publishers.
4. Kolchin.A. and Demidov.V. " *Design of Automotive Engines* ".

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- 1. Study of NDIR Gas Analyser and FID.
- 2. Study of Chemiluminescent NO_x analyzer.
- 3. Measurement of HC, CO, CO₂, O₂ using exhaust gas analyzer.
- 4. Diesel smoke measurement.
- 5. Study of rectifiers and filters.
- 6. Characteristics of amplifiers.
- 7. Study of Logic Gates, Adder and Flip-Flops.
- 8. Study of SCR and IC timer.
- 9. D/A and A/D Converters.
- 10. Assembly language programming exercise.
- 11. Interfacing A/D converter and simple data acquisition.
- 12. Interfacing Stepper motor control and CRT terminal.
- 13. Micro controller Programming and Interfacing.

Total No of periods:

AT348 Comprehension**0 0 3 100****45**

The objective of Comprehension is to provide opportunity for the student to apply the knowledge acquired during the academic programme to real-life problems which he/she may have to face in future as an engineer. Three periods per week shall be allotted in the time tables for this activity and this time shall be utilized by the students to receive guidance from the members of faculty on solving real-life problems, practice solving these problems and on group discussions, seminar presentations, library reading as assigned by the faculty member incharge.

For internal assessment, there will be 3 or 4 written tests covering all the courses studied in previous semesters. The written tests may be of objective type of questions, short answer questions, etc.

Total No of periods: 45

1. INTRODUCTION	8
Fundamental of vibration, Mechanical vibrating systems. Modelling and Simulation - Model of an automobile - Single, two, multi degrees of freedom systems - Free, forced and damped vibrations. Magnification factor - Transmissibility - Vibration absorber.	
2. MULTI DEGREE OF FREEDOM SYSTEMS	14
Closed coupled system - Eigen value problems - Far coupled Systems - Orthogonality of mode shapes - Modal analysis - Forced vibration by matrix inversion. Approximate methods for fundamental frequency - Dunkerley's lower bound - Rayleigh's upper bound - Hozler method for close coupled systems and branched systems.	
3. SUSPENSION AND TYRES	8
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 directions. Ride characteristics of tyre - Effect of driving and braking torque - Gough's tyre characteristics.	
4. VEHICLE HANDLING	7
Oversteer, under steer, steady state cornering. Effect of braking, driving torques on steering. Effect of camber, transient effects in cornering. Directional stability of vehicles.	
5. STABILITY OF VEHICLES	7
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.	

Total No of periods: 44

Text Books:

1. Gillespie.T.D., " *Fundamental of vehicle dynamic society of Automotive Engineers* ",
Ic USA, 1992.

References:

1. Heldt.P.M. " *Automotive Chassis* ", Chilton Co., New York, 1992.

2. Ellis.J.R., " *Vehicle Dynamics* ", Business Books Ltd., London, 1991.

3. Giles.J.G. *Steering, " Suspension and Tyres "*, Illiffe Books Ltd, London, 1998.

4. Giri.N.K., " *Automobile Mechanics* ", Khanna Publishers. New Delhi, 1986.

5. Rao.J.S. & Gupta.K., " *Theory and Practice of Mechanical Vibrations* ", Wiley Eastern
Ltd., New Delhi, 1999.

1. MAINTENANCE RECORDS AND SCHEDULE	9
Importance of maintenance. Scheduled and unscheduled maintenance. Preparation of check lists. Chassis lubrication. Cost effectiveness. Pre-trip. Inspection forms. Log books. Trip sheets. Other maintenance record forms	
2. MAINTENANCE, REPAIR AND OVERHAULING OF ENGINE	9
Dismantling of engine components. Cleaning methods. Visual inspection and dimensional check of various engine components. Minor and Major tune up Reconditioning, repairing methods of engine components. Assembly procedure. Special tools used for maintenance, repair and overhauling.	
3. MAINTENANCE, REPAIR AND OVERHAULING OF CHASSIS DRIVE LINE COMPONENTS	9
Clutch - Mechanical, Automatic types Gear box - Mechanical Automatic types. Final reduction. Propeller shaft. Front and rear suspension systems. Rigid and independent types. Brakes systems - Hydraulic, Servo, Air. Air bleeding. Steering system. Wheel alignment - Tyres.	
4. MAINTENANCE, REPAIR AND SERVICING OF ELECTRICAL SYSTEMS	9
Battery - Testing methods. Starter motor. Charging system - DC Generator, AC Alternator, Regulator, Ignition systems - Coil ignition, Transistor assisted ignition, Capacitor discharge ignition. Electric Horn, Wiper, Flasher, Electric fuel pump, Gauges. Lighting system Head lights focussing. Wiring system.	
5. MAINTENANCE, REPAIR AND SERVICING OF COOLING SYSTEM, LUBRICATION SYSTEM, FUEL SYSTEM AND BODY	9
Cooling system - types, water pump, radiator, thermostat valve. anti corrosion and anti freezing solutions. Lubricating system - Oil analysis, oil topping up, oil change, oil filters, oil relief valve. Fuel system - Petrol, diesel fuel feed system components. Body repair tools, minor body panel beating, tinkering, soldering, polishing, painting. Door locks mechanism. Window glass actuating mechanism.	
Total No of periods: 45	

References:

1. *JOHN Doke, " Fleet management ", McGraw Hill Co, 1984.*
2. *Judge.A.N., " Motor vehicle engine servicing, 3rd, Edition ", Pitman Paperpack, London, 69.*
3. *Judge.A.W., " Maintenance of High speed diesel engines ", Chapman Hall Ltd., London, '56.*
4. *Maleev.V.L., " Diesel Engine operation and Maintenance ", Maintenance, McGraw Hill Book Co., New York, 1954.*
5. *John.W.Vale.J.R., " Modern Auto Body and Finder repair ".*
6. *Venk.Spicer." Automotive Maintenance and Trouble shooting ".*
7. *" Vehicle Service Manuals of reputed manufactures ".*

Text Books:

1. *G.M.Masters, Introduction to Environmental Engineering & Science, Prentice Hall, New Delhi, 1997*
2. *J.G. Henry and G. W. Heike, Environmental Science & Engineering", Prentice Hall International Inc., New Jersey, 1996.*

References:

1. *S. K. Dhameja, Environmental Engineering and Management, S. K. Kataria and Sons, New Delhi, 1999.*
2. *State of India's Environment - A Citizen's Report, Centre for Science and Environment and Others, 1999*
3. *Shyam Divan and Armin Rosencranz, Environmental Law and Policy in India, Cases, Materials and Statutes, Oxford University Press, 2001.*

1. 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 - theories about right action - self-interest-customs and religion - uses of ethical theories

2. ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics-a balanced outlook on law-the challenger case study

3. ENGINEER'S RESPONSIBILITY FOR SAFETY 9

Safety and risk - assessment of safety and risk - risk benefit analysis-reducing risk-the three mile island and Chernobyl case studies.

4. 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.

5. GLOBAL ISSUES 9

Multinational corporations - environmental ethics-computer ethics-weapons development-engineers as managers-consulting engineers-engineers as expert witnesses and advisors-moral leadership-sample code of conduct.

Total No of periods: 45

Text Book:

1. *Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York 1996.*

References :

1. *Charles D. Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.*
2. *Laura Schlesinger, "How Could You Do That: The Abdication of Character, Courage, and Conscience", Harper Collins, New York, 1996.*
3. *Stephen Carter, "Integrity", Basic Books, New York, 1996.*
4. *Tom Rusk, "The Power of Ethical Persuasion: From Conflict to Partnership at Work and in Private Life", Viking, New York, 1993*

1. ORGANISATIONS 8

General Principles-Management concepts-Schools of management thoughts-Scientific and Japanese Management Trends-Management Functions. Organisations- Types-Properties-Comparison.

2. PRODUCTION AND OPERATION MANAGEMENT 18

Plant location-Layout-Methods of Study-Time study-Inventory-Types and control-Maintenance & Replacement-Quality control-Inspection-Acceptance Sampling and Statistical Quality control charts-Quantitative Techniques-Linear programming-Transportation and Assignment Problems-Sequencing and Routing-Queuing theory-Network Techniques-CPM and PERT,Role of EDI in inventory control

3. PERSONNEL MANAGEMENT 8

Functions-Recruitment and Training Appraisal-Counselling-Leadership and Motivation-Organisational Communication-Conflict and Change,Industrial Relations-Trade Union Disputes

4. FINANCIAL MANAGEMENT 6

Capital-Types-Sources-Manageial Economics-Supply and Demand-Savings-Investment-Consumption-Demand and Price Elasticities-Production function-Costing-Types-Break even analysis-Financial Statements

5. MARKETING MANAGEMENT 5

Product Life Cycle-Design-Forecasting-Sales and Marketing-Strategies

Total No of periods: 45

References:

1. *Carl R.Andersation, " Management " -Allyn and Bacon Inc.,Boston,1988*
2. *Levin R.Quantitative " Approaches to Management ",McGraw Hill Book Co.,1986*
3. *Koontz and O"Donnel, " Essentials of Management " ,McGraw Hill Book Co.,1992*
4. *Besterfield D.H, " Quality Control ",Prentice Hall of India,1995*
5. *Pandey,I.M., " Financial Management ",Vikas Publishing Co.,1979*
6. *Philip Kotler, " Principles of Marketing ", Prentice Hall of India,1984*

AT433 Computer Aided Design Application for Automotive Chassis Design

2 0 3 100

75

1. CLUTCH

Complete design of clutch components. Components and assembly drawing using Drafting software.

2. GEAR BOX

Gear train calculations, layout of gear box. Calculation of bearing loads and selection of bearings. Complete assembly drawing using Drafting software.

Total No of periods: 75

Text Books:

1. Heldt.P.M. "Automotive Chassis ", Chilton Book Co., 1992.
2. Heldt.P.M. "Torque Converters, Chilton Book Co., 1992.

References:

1. Dean Aaverns., "Automobile Chassis Design ", Illiffe Book Co., 1982.
2. Giri.N.K., "Automobile Mechanics ", Khanna Publishers, New Delhi, 1998.
3. "The Automotive Chassis : Engineering Principles ", SAE - Sep, 1995.

AT434 Vehicle Maintenance Laboratory**0 0 3 100**

- | | | |
|---|--|----------|
| 1. | | 5 |
| Study and layout of an automobile repair, service and maintenance shop. | | |
| 2. | | 5 |
| Study and preparation of different statements / records required for the repair and maintenance works. | | |
| 3. | | 5 |
| Study and preparation of the list of different types of tools and instruments required. | | |
| 4. | | 5 |
| Minor and major tune up of gasoline and diesel engines. | | |
| 5. | | 5 |
| Fault diagnosis in electrical ignition system, gasoline fuel system, diesel fuel system and rectification. | | |
| 6. | | 5 |
| Study of the faults in the electrical systems such as Head lights, Side or Parking lights, Trafficator lights, Electric horn system, Windscreen wiper system, Starter system and Charging system. | | |
| 7. | | 5 |
| Study of fuel filters (both gasoline and diesel engines) and air cleaners (dry and wet) | | |
| 8. | | 5 |
| Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms. | | |
| 9. | | 5 |
| Practice the following: | | |
| i) Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play | | |
| ii) Air bleeding from hydraulic brakes, air bleeding of diesel fuel system | | |
| iii) Wheel bearings tightening and adjustment | | |
| iv) Adjustment of head lights beam | | |
| v) Removal and fitting of tyre and tube | | |

Total No of periods: 45

References:

1. *" Service Manuals of reputed vehicles "*.
2. *" Automotive Trouble shooting and Maintenance "*, by Anderson Ashburn.
3. Venk.Spicer, *" Automotive Maintenance and Trouble shooting "*.

1. 60

1. The students have to undergo practical industrial training for six weeks (during vacation at the end of VI semester) in recognised industrial establishments.

2.

At the end of the training they have to submit a report with following information :

1. Profile of the Industry
2. Product range
3. Organisation structure
4. Plant layout
5. Processes/Machines/Equipment/devices
6. Personnel welfare schemes
7. Details of the training undergone
8. Projects undertaken during the training, if any
9. Learning points.

3.

End Semester examination will be a Viva-Voce Examination.

Total No of periods: 60

1. INTRODUCTION**9**

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

2. TQM PRINCIPLES**9**

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDCA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

3. STATISTICAL PROCESS CONTROL (SPC)**9**

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

4. TQM TOOLS**9**

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

5. QUALITY SYSTEMS**9**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits.

TEXT BOOK:

1. Dale H.Besterfield, et al., Total Quality Management, Pearson Education Asia, 1999. (Indian reprint 2002).

REFERENCES:

1. James R.Evans & William M.Lindsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. “Total Quality Management, McGraw-Hill, 1991.
3. Oakland.J.S. “Total Quality Management Butterworth – Heinemann Ltd., Oxford. 1989.
4. Narayana V. and Sreenivasan, N.S. Quality Management – Concepts and Tasks, New Age International 1996.
5. Zeiri. “Total Quality Management for Engineers Wood Head Publishers, 1991.

AT437 Project Work**0 0 12 200****180**

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

Every project work shall have a Guide who is a member of the faculty of the Institution. Twelve periods per week shall be allotted in the Time table for this important activity and this time shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis, or field work as assigned by the Guide and also to present in periodical seminars or viva to review the progress made in the project.

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

The Progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.

Total No of periods: 180