



ANNA UNIVERSITY
Chennai-25.
Syllabus for

B.E.(Full Time) Automobile Engineering

AT034 Advanced Theory of IC Engines **3 0 0 100**

1 . CYCLE ANALYSIS **5**

Operating cycles of S.I. and C.I. engines and Gas turbines - Comparison of Air standard cycle - Fuel air cycle and actual cycle.

2 . COMBUSTION OF FUELS **12**

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

3 . COMBUSTION MODELLING **12**

Basic concepts of engine simulation - Governing equation - Flow models, thermodynamic models - SI engine and CI engine models.

4 . ADVANCES IN IC ENGINES **8**

Adiabatic and L.H.R. engines - MAN combustion chamber and multifuel engines - Stratified charged and lean burn engines - Locomotive and marine engines.

5 . OPERATION AND PERFORMANCE **8**

Computer control of engine parameters for pollution control and better efficiency - Closed loop control of engine parameters - Hybrid operation - performance maps.

Total No of periods: 45

Text Books:

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

References:

1. Ganesan.V., " *Compute Simulation of Spark Ignition engine process* ", Universities Press (India) Ltd, Hyderabad, 1996.
2. John.B., Heywood, " *Internal Combustion Engine Fundamentals* ", McGraw Hill Publishing Co., New York, 1990.

1 . INTRODUCTION 7

Estimation of petroleum reserve - Need for alternate fuel - Availability and properties of alternate fuels - general use of alcohols - LPG - Hydrogen - Ammonia, CNG, and LNG - Vegetable oils and Biogas - Merits and demerits of various alternate fuels.

2 . ALCOHOLS 9

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

3 . 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 for LPG - Hydrogen - Storage and handling, performance and safety aspects.

4 . VEGETABLE OILS 10

Various vegetable oils for engines - Esterification - Performance in engines - Performance and emission characteristics

5 . ELECTRIC AND SOLAR POWERED VEHICLES 10

Layout of an electric vehicle - Advantage and limitations - Specifications - System component. Electronic control system - High energy and power density batteries - Hybrid vehicle - Solar powered vehicles.

Total No of periods: 45

References:

1. *Maheswar Dayal, " Energy today & tomorrow ", I & B Horishr India, 1982.*
2. *Nagpal, " Power Plant Engineering ", Khanna Publishers, 1991.*
3. *" Alcohols and motor fuels progress in technology ", Series No.19, SAE Publication USA 1980.*
4. *SAE Paper Nos. 840367, 841156, 841333, 841334.*
5. *" The properties and performance of modern alternate fuels " - SAE Paper No.841210.*
6. *Bechtold. R.L., " Alternative Fuels Guide Book ", SAE, 1997.*

1 . INTRODUCTION 10

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

2 . AERODYNAMIC DRAG OF CARS 8

Cars 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.

3 . SHAPE OPTIMIZATION OF CARS 7

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

4 . VEHICLE HANDLING 10

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

5 . WIND TUNNELS FOR AUTOMOTIVE AERODYNAMIC 10

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

Total No of periods: 45

Text Books:

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

References:

- 1. Pope. A., " Wind Tunnel Testing ", John Wiley & Sons, 2nd Edn, New York, 1974.*
- 2. Automotive Aerodynamic : Update SP-706, SAE, 1987.*
- 3. Vehicle Aerodynamic, SP-1145, SAE, 1996.*

1 . 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.

2 . AIR CONDITIONER - HEATING SYSTEM 9

Automotive heaters - Manually controlled air conditioner - Heater system - Ford automatically controlled air conditioner and heater systems - Automatic temperature control - Air conditioning protection - Engine protection.

3 . REFRIGERANT 9

Containers - Handling refrigerants - Tapping into the refrigerant container - Refrigeration system diagnosis - Diagnostic procedure - Ambient conditions affecting system pressures.

4 . AIR ROUTING & TEMPERATURE CONTROL 9

Objectives - Evaporator care air flow through the Dash recirculating unit - Automatic temperature control - Duct system - Controlling flow - Vacuum reserve - Testing the air control and handling systems.

5 . 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 No of periods: 45

Text book:

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

References:

1. Mitchell information Services, Inc, " Mitchell Automatic Heating and Air Conditioning Systems ", Prentice Hall Ind., 1989.

2. Paul Weiser, " Automotive Air Conditioning ", Reston Publishing Co Inc., 1990.

3. MacDonal, K.L., " Automotive Air Conditioning ", Theodore Audel series, 1978.

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

AT038 Offroad Vehicles

3 0 0 100

1 . CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES 8

Power plants, chassis and transmission, Multi-axle vehicles.

2 . LAND CLEARING MACHINES 6

Bush cutter, stampers, Tree dozer, Rippers.

3 . EARTH MOVING MACHINES 10

Bulldozers, cable and hydraulic dozers. Crawler track, running and steering gears, scrapers, drag and self powered types - Dump trucks and dumpers - Loaders, single bucket, multi bucket and rotary types - Power and capacity of earth moving machines.

4 . SCRAPERS AND GRADERS 9

Scrapers, elevating graders, self powered scrapers and graders.

5 . SHOVELS AND DITCHERS 12

Power shovel, revolving and stripper shovels - drag lines - ditchers - Capacity of shovels.

Total No of periods: 45

References:

- 1. Abrosimov. K. Bran berg.A. and Katayer.K., " Road making Machinery ", MIR Publishers, Moscow, 1971.*
- 2. Wang.J.T., " Theory of Grand vehicles ", John Wiley & Sons, New York, 1987.*
- 3. Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998.*

AT038 Offroad Vehicles

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Power shovel, revolving and stripper shovels - drag lines - ditchers - Capacity of shovels.

Total No of periods: 45

1 . INTRODUCTION TO COMBUSTION PROCESSES 6

Combustion in premixed and diffusion flames - Combustion process in IC engines.

2 . NORMAL, ABNORMAL COMBUSTION IN SI ENGINES 11

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

3 . COMBUSTION AND KNOCK IN CI ENGINES 11

Droplet and spray combustion theory - stages of combustion - delay period - peak pressure - Heat release - Gas temperature - Diesel knock.

4 . HEAT TRANSFER IN IC ENGINES 11

Basic definitions - Convective heat transfer - Radiative heat transfer - Heat transfer, temperature distribution and thermal stresses in piston - Cylinder liner - Cylinder head - fins and valves.

5 . EXPERIMENTAL INVESTIGATION OF COMBUSTION AND HEAT TRANSFER IN IC ENGINES 6

Photographic studies of combustion processes - P-q diagram in SI and CI engines. Anemometry - Temperature measurement in piston - cylinder liner - cylinder head and engine valves.

Total No of periods: 45

Text Books:

1. SPALDING.D.B., " *Some fundamental of Combustion* ", Butterworth Science Publications, London, 1985.

References:

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

1 . INTRODUCTION TO COMBUSTION PROCESSES 6

Combustion in premixed and diffusion flames - Combustion process in IC engines.

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Total No of periods: 45

1 . VEHICLE FRAME AND SUSPENSION 9

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

2 . FRONT AXLE AND STEERING SYSTEMS 9

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

3 . CLUTCH 9

Torque capacity of clutch. Computer aided design of clutch components, Design details of roller and sprag type of clutches.

4 . GEAR BOX 9

Computer aided design of three speed and four speed gear boxes.

5 . DRIVE LINE AND REAR AXLE 9

Computer aided 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.

Total No of periods: 45

Text Books:

1. *Dean Averns, " Automobile Chassis Design ", Illiffe Books Ltd, 1992.*

References:

1. *Heldt.P.M., " Automotive Chassis ", Chilton Co., New York, 1992.*
2. *Steeds.W., " Mechanics of Road vehicles ", Illiffe Books Ltd., London, 1990.*
3. *Giles.J.G., Steering, " Suspension and tyres ", Illiffe Books Ltd., London, 1988.*
4. *Newton, Steeds & Garret, " Motor vehicle ", Illiffe Books Ltd., London, 1982.*
5. *Heldt.P.M., " Torque converter ", Chilton Book Co., New York, 1982.*
6. *Giri.N.K. " Automobile Mechanics ", Khanna Publisher, New Delhi, 1996.*

AT041 Computer Graphics and Design

3 0 0 100

1 . COMPUTER HARDWARE AND SOFTWARE 10

Introduction - An overview of CAD - Computer fundamentals - Classification of computers - Data communication - Configuration of computer system for design - Design work stations - Interactive display devices - Input devices - Output devices - Computer software.

2 . COMPUTER DRAFTING 12

Graphical input techniques - Transformation in graphics - Drafting through level languages - Fundamental of 2D drafting - 3D drawings.

3 . MODELLING OF CURVES, SURFACES AND SOLIDS 13

Introduction - 3D geometry - Surface types - Conventions - Attributes - Geometry - Examples of surface modelling - Solid modelling.

4 . GRAPHIC STANDARDS 5

Introduction - Standards for graphics programming - Graphic standards - Product data exchange specification - Other data exchange formats.

5 . INTERFACING DESIGN ANALYSIS AND DRAFTING 5

Introduction - Parametric design - Script file - Application of a drawing exchange file - A design and drafting examples - Operation of Batch mode.

Total No of periods: 45

Text Books:

1. Radhakrishnan.P. and Kothandaraman.C.P., " Computer Graphics and Design ", Dhanpal Rai & Sons, Delhi 1990.

References:

1. Ramamurthi.V., " Computer Aided Design in Mechanical Engg "., Tata McGraw Hill, New Delhi, 1987.

1 . INTRODUCTION 5

Fundamental concepts in manufacturing and automation - Need for automation - Automation strategies - Economic analysis and production - Fundamental of CIMS.

2 . COMPUTER AIDED DESIGN (CAD) 8

Elements of CAD system - Graphics hardware - ALU - CPU - Input/Output devices - Geometric modelling - Automated drafting .

3 . MANUFACTURING SYSTEMS 12

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

4 . FLEXIBLE MANUFACTURING SYSTEMS 9

Group technology - Part families - Part classification and cooling - Production flow analysis - Machine cell design - Description of FMS - Equipment, Tooling and fixture.

5 . COMPUTER AIDED MANUFACTURING 11

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

Total No of periods: 45

Text Book:

1. Groover.M.P., " Automation Production Systems and CAM ", Prentice Hall, 1990.

References:

- 1. Groover. M.P., " CAD/CAM Computer Aided Design and Manufacturing ", Prentice Hall, 1990.*
- 2. Barry Hawkar, " CAD/CAM Processes ", Pitman, 1988.*
- 3. Niebel, " Modern Manufacturing Process Engineering ", McGraw-Hill, 1989.*
- 4. Martin, S.J., " Numerical control of Machine Tools ", ELBS, London, 1980.*
- 5. Weatherhall. A., " Computer Intergrated Manufacturing ", Affiliated East-West, 1988.*

1 . INTRODUCTION 10

Introduction - Heat of reaction - Measurement of URP - Measurement of HRP - Adiabatic flame temperature: Complete combustion in C/H/O/N Systems, Constant volume adiabatic combustion, constant pressure adiabatic combustion. Calculation of adiabatic flame temperature - Isentropic changes of state.

2 . SI ENGINE SIMULATION WITH AIR AS WORKING MEDIUM 10

Deviation between actual and ideal cycle - Problems, SI engine simulation with adiabatic combustion, temperature drop due to fuel vapourisation, full throttle operation - efficiency calculation, part-throttle operation, super charged operation.

3 . PROGRESSIVE COMBUSTION 10

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

4 . SIMULATION OF 2-STROKE SI ENGINE 5**5 . DIESEL ENGINE SIMULATION 10**

Multi zone model for combustion, different heat transfer models, equilibrium calculations, simulation of engine performance, simulation for pollution estimation.

Total No of periods: 45

References:

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

1 . INTRODUCTION 4

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

2 . DISCRETE ELEMENTS 10

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

3 . CONTINUUM ELEMENTS 20

Different forms of 2D elements and their applications for plane stress, plane strain and axi-symmetric problems. Consistent and lumped formulation. Use of local coordinates. Numerical integration.

4 . ISO PARAMETRIC ELEMENTS 8

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

5 . SOLUTION SCHEMES 3

Different methods of solution of simultaneous equation governing static, dynamic and stability problems, General purpose software packages.

Total No of periods: 45

Text Books:

1. *Seegerlind.L.J., " Applied Finite Element Analysis ", Second Edition, John Wiley and Sons Inc., New York, 1984.*

References:

1. *Bathe.K.J. and Wilson.E.L., " Numerical methods in finite elements analysis ", Prentice Hall of India Ltd, 1983.*
2. *Cook.R.D., " Concepts and Applications of Finite Element analysis ", 3rd Edition, John Wiley & Sons, 1989.*
3. *Krishnamurthy.C.S., " Finite Elements analysis ", Tata McGraw Hill, 1987.*
4. *Ramamurthi.V., " Computer Aided Design in Mechanical Engg. ", Tata McGraw-Hill, 1987.*

1 . MANAGEMENT TRAINING AND OPERATIONS 10

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

2 . VEHICLE MAINTENACE 8

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

3 . VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET 10

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

4 . SCHEDULING AND FARE STRUCTURE 10

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

5 . MOTOR VEHICLE ACT 7

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

Total No of periods: 45

Text Book:

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

References:

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

1 . ARCHITECTURE	6
General 8 bit micropocessor and its architecture 8085, Z-80 and MC 6800 MPU and its pin function - Architecture - Function of different sections.	
2 . INSTRUCTION SET	10
Instruction format - addressing modes - insruction set of 8085 MPU-T-STATE - Machine cycle and instruction cycles - Timing diagrams - Different machine cylices - Fetch and execute operations - estimation of execution times.	
3 . ASSEMBLY LANGUAGE PROGRAMMING	10
Construct of the language programming - Assembly format of 8085 - Assembly Directive - Multiple precision addition and subtraction - BCD to Binary and Binary to BCD, Multiplication, Division, Code conversion using look up tables - Stack and subroutines.	
4 . DATA TRNSFER SCHEMES	5
Interrupt structure - Programmed I/O - Interrupt driven I/O, DMA - Serial I/O.	
5 . INTERFACING DEVICES	8
Types of interfacing devices - Input / Output ports 8212, 8255, 8251, 8279. Octal latches and tristate buffers - A/D and D/A converters - Switches, LED's ROM and RAM interfacing.	
6 . APPLICATIONS	6
Data acquisitions - Temperature control - Stepper motor control - Automotive applications Engine control, Suspension system control, Driver information systems), Development of a high speed, high precision learning control system for the engine control.	
Total No of periods: 45	

Text Book:

1. *Ramesh, Goankar.S., " Microprocessor Architecture Programming and Applications ", Wiley Eastern Ltd., New Delhi, 1986.*

References:

1. *Aditya.P.Mathur, " Introduction to Microprocessors ", III Edition, Tata McGraw-Hill Publishing Co Ltd., New Delhi, 1989.*
2. *Ahson.S.I. " Microprocessors with Applications in Process Control ", Tata McGraw-Hill, New Delhi, 1986.*
3. *SAE Transactions, 1986 Sec 3.*
4. *Jabez Dhinagar.S., " Microprocessor Application in Automoblies ".*
5. *L.Bianco and A.Labella., " Automotive Micro Electronics ", Elsevier science publishers. 1986.*

1 . SINGLE VARIABLE OPTIMIZATION ALGORITHM	10
Introduction - Engineering optimization problems - Optimality criteria - Bracketing methods - Region elimination methods - Point estimation methods - Gradient based methods - Root finding using optimization techniques - Computer Programmes.	
2 . MULTI VARIABLE OPTIMIZATION ALGORITHM	8
Optimality criteria - Unidirectional search - Direct search methods - gradient based methods - Computer programmes.	
3 . CONSTRAINED OPTIMIZATION ALGORITHMS	12
Kuhn-Tucker conditions - Transformation methods - sensitivity analysis - Direct search for constrained minimization - Unearized search techniques method - Gradient projection method - Computer programmes	
4 . SPECIALIZED ALGORITHMS	5
Integer programming - Geometric programming	
5 . NON TRADITIONAL OPTIMIZATION ALGORITHMS	10
Genetic algorithms - Simulated annealing - Global optimization - Computer programmes.	

Total No of periods: 45

Text Book:

1. *Kalyanmay Deb, " Optimization for Engineering Design ", Prentice Hall of India, New Delhi.*

References:

1. *Taha.M.A., " Operations Research ", Macnillan, New York, 1986.*
2. *Rao.S.S., " Optimization theory and application ", Wiley Eastern, New Delhi, 1990.*
3. *Murthy, " Linear Programming ", Wiley New York, 1987.*
4. *Rekiaaitis.G.V. Ravindran.A. and Regedell K.M., " Engineering optimization methods and applications ", Wiley, New York, 1986.*
5. *Conley.W., " Computer Optimization Techniques ", Pntrecelli Book, 1980.*

- 1 . POWER METALLURGY 5**
Process flow chart - Production of metal powders and their raw materials - Manufacture of friction lining materials for clutches and brakes - Testing and inspection of PM parts.
- 2 . FORMING PROCESS 15**
Forging - process flow chart, forging of valves, connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles, Extrusions: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Hydroforming: Process, hydro forming of manifold and comparison with conventional methods- Hydro forming of tail lamp housing. Stretch forming - Process, stretch forming of auto body panels - Super plastic alloys for auto body panels.
- 3 . CASTING AND MACHINING 12**
Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston, pressure die casting of carburettor other small auto parts. Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins - piston rings - valves - front and rear axle housings - fly wheel - Honing of cylinder bores - Copy turning and profile grinding machines.
- 4 . GEAR MANUFACTURING 5**
Gear milling, Hobbing and shaping - Gear finishing and inspection.
- 5 . RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS 8**
Powder injection moulding - Shotpeen hardening of gears - Production of aluminium MMC liners for engine blocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming - Squeeze casting of pistons - aluminium composite brake rotors

Total No of periods: 45

Text Book:

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

References:

1. Haslehurst.S.E., " *Manufacturing Technology* ", ELBS, London, 1990.

2. Rusinoff, " *Forging and Forming of metals* ", D.B. Taraporevala Son & Co. Pvt Ltd., Mumbai, 1995.

3. Sabroff.A.M. & Others, " *Forging Materials & Processes* ", Reinhold Book Corporation, New York, 1988.

4. Upton, " *Pressure Die Casting* ", pergamon Press, 1985.

5. *High Velocity Forming of Metals* ", ASTME, prentice Hall of India (P) Ltd., New Delhi, 1990.

1 . INTRODUCTION 4

Definitions of Jigs and Fixtures - Principles of Jigs and Fixtures design - Preliminary analysis and planning of jigs and fixture parts and their materials - Basic steps in the design of jigs and fixtures - Advantages of Jigs & Fixtures.

2 . LOCATION AND CLAMPING 16

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

3 . LOADING AND UNLOADING PROBLEMS 5

Loading - Entering, locating and clamping symmetric consideration.

Unloading - Bur clearance, ejectors, receivers, chip problems, relief and projection, shields and seals.

4 . CUTTER GUIDANCE 5

various types of setting blocks - Press fit bushes - Renewable bushes - Slip bushes - Threaded bushes - Special bushes - Drills with attached bushing for small holes.

5 . DESIGN OF JIGS AND FIXTURES 15

Three construction principles - Builtup type, casting and weldment Practising the various types of jigs - Practising the various types of milling fixtures - broaching fixtures - function of broaching fixtures - Internal and external broaching fixtures.

Total No of periods: 45

Text Book:

1. Kempster., M.H.A., " Introduction to jig and tool design ", ELBS Edition, 1990.

References:

- 1. Henriksen, Erik.K., " Jigs and Fixtures ", Design Manual Industrial Press Inc., Madison Avenue, New York, 1983.*
- 2. Donaldson.G.H., Lecain, Gould.V.V., " Tool design ", TMH Edition, 1990.*
- 3. ASTME, " Fundamental of Tool design ", Prentice Hall, 1989.*
- 4. Joshi.P.H. " Jigs and Fixtures ", Tata McGraw-Hill, 1988.*

AT050 Tractor and Farm Equipments

3 0 0 100

1 . GENERAL DESIGN OF TRACTORS

10

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

2 . CONTROL OF THE TRACTOR AND FUNDAMENTALS OF ENGINE OPERATION

10

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

3 . ENGINE FRAME WORK AND VALVE MECHANISM OF TRACTOR

10

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

4 . COOLING SYSTEM, LUBRICATION SYSTEM AND FUEL SYSTEM OF A TRACTOR

10

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

5 . FARM EQUIPMENTS

5

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

Total No of periods: 45

References:

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

1 . SOLAR ENERGY 5

Conversion of solar energy to electrical energy - availability - advantages and limitations - Power systems.

2 . WIND ENERGY 5

Wind mapping - location of wind generators - types of wind mills and generators - Induction and synchronous systems.

3 . BIO-MASS 10

Sources of bio-mass energy - Wood and agricultural waste - Municipal waste - Animal waste - Energy conversion systems - Biogas generation from animal waste - Wood gasification - Downdraft and fluidised bed systems - Alcohol fuels.

4 . OTHER SOURCES 12

Wave energy - Scope and simple systems for power generation - tidal power - scope and applications. OTEC scope fundamental principles and operating systems for power generation. Geo thermal energy - Principle and simple systems for power generation.

5 . AUTOMOTIVE APPLICATIONS 13

Electric car operation with energy stored in battery - Energy converted to hydrogen engine operation - Hydrogen conversion and storage system - Relative merits - Direct operation of vehicle by biomass fuels like wood chips, rice husk and alcohol.

Total No of periods: 45

References:

1. *F.S.Seiler., " Alternate energy vehicle information ", Wind Book Inc., 1977.*
2. *T.Nejat Veziroyqlu., " Alternative energy sources - III " Hemisphere Publishing Co., 1989.*
3. *Barbara Keiler., " Energy Alternatives ", Luscent books, 1990.*
4. *David Hafemeister, Henry Kelly, Barbara G.Levi, American Institute of Physics, 1985.*

1 . TRENDS IN POWER PLANTS 9

Hybrid vehicles - Stratified charged / lean burn engines - Hydrogen engines - battery vehicles - Electric propulsion with cables - Magnetic track vehicles.

2 . SUSPENSION BRAKES AND SAFETY 9

Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passenger comfort.

3 . NOISE & POLLUTION 9

Reduction of noise - Internal & external pollution control through alternate fuels/power plants - Catalytic converters and filters for particulate emission.

4 . 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.

5 . 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.

Total No of periods: 45

References:

1. *Beranek.L.L. " Noise Reduction ", McGraw-Hill Book Co., Inc, New York, 1993.*
2. *" Bosch Hand book ", 3rd Edition, SAE, 1993.*

AT053 Total life cycle management

3 0 0 100

1 . INTRODUCTION 9

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

2 . VEHICLES END OF LIFE 9

Design for end of old vehicle management - Problems of old vehicles in emerging markets - Recovery and economic feasibility of materials such as plastic, rubber, aluminium, steel, etc.

3 . TRADEOFFS 9

Applying life cycle thinking to define tradeoffs along the supply, manufacture - Use and end of life chain - Effects on the customer - Expectation of the customer - Evaluate product cost on fuel consumption, emission, durability, environment and health.

4 . SUSTAINABILITY 9

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

5 . HARMONIZATION OF ENVIRONMENTAL GOALS 9

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

Total No of periods: 45

References:

1. *" Life cycle Management and Assessment "*, SAE, May, 1997.
2. *" Accident Reconstruction - Automobiles ", Tractors - Semi Trailers. Motor cycles and Pedestrians*, SAE, 1987.

References:

1. *HARRY NYSTROM, " Creativity and innovation", John Wiley & Sons, 1979.*
2. *BRAIN TWISS, " Managing technological innovation", Pitman Publishing Ltd., 1992.*
3. *HARRY B.WATTON, " New Product Planning ", Prentice Hall Inc., 1992.*
4. *P.N.KHANDWALLA - " Fourth Eye (Excellence through Creativity) - Wheeler Publishing ", Allahabad, 1992.*
5. *I.P.R. Bulletins, TIFAC, New Delhi, 1997.*

GE037 Intellectual Property Rights (IPR)**3 0 0 100****1 . UNIT I 5**

Introduction - Invention and Creativity - Intellectual Property (IP) - Importance - Protection of IPR - Basic types of property (i. Movable Property ii. Immovable Property and iii. Intellectual Property).

2 . UNIT II 10

IP - Patents - Copyrights and related rights - Trade Marks and rights arising from Trademark registration - Definitions - Industrial Designs and Integrated circuits - Protection of Geographical Indications at national and International levels - Application Procedures.

3 . UNIT III 10

International convention relating to Intellectual Property - Establishment of WIPO - Mission and Activities - History - General Agreement on Trade and Tariff (GATT).

4 . UNIT IV 10

Indian Position Vs WTO and Strategies - Indian IPR legislations - commitments to WTO-Patent Ordinance and the Bill - Draft of a national Intellectual Property Policy - Present against unfair competition.

5 . UNIT V 10

Case Studies on - Patents (Basumati rice, turmeric, Neem, etc.) - Copyright and related rights - Trade Marks - Industrial design and Integrated circuits - Geographic indications - Protection against unfair competition.

Total No of periods: 45

TEXT BOOK

1. Subbaram N.R. " Handbook of Indian Patent Law and Practice ", S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.

REFERENCES

- 1. Eli Whitney, United States Patent Number : 72X, Cotton Gin, March 14, 1794.*
- 2. Intellectual Property Today : Volume 8, No. 5, May 2001, [www.iptoday.com].*
- 3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000. [www.ipmatters.net/features/000707_gibbs.html.*

1 . UNIT I 9

Historical Background - Constituent Assembly of India - Philosophical foundations of the Indian Constitution - Preamble - Fundamental Rights - Directive Principles of State Policy - Fundamental Duties - Citizenship - Constitutional Remedies for citizens.

2 . UNIT II 9

Union Government - Structures of the Union Government and Functions - President - Vice President - Prime Minister - Cabinet - Parliament - Supreme Court of India - Judicial Review.

3 . UNIT III 9

State Government - Structure and Functions - Governor - Chief Minister - Cabinet - State Legislature - Judicial System in States - High Courts and other Subordinate Courts

4 . UNIT IV 9

Indian Federal System - Center - State Relations - President's Rule - Constitutional Amendments - Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

5 . UNIT V 9

Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens - Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

Total No of periods: 45

TEXT BOOKS

1. *Durga Das Basu, " Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.*
2. *R.C.Agarwal, " (1997) Indian Political System ", S.Chand and Company, New Delhi.*
3. *Maciver and Page, " Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi.*
4. *K.L.Sharma, " (1997) Social Stratification in India: Issues and Themes ", Jawaharlal Nehru University, New Delhi.*

REFERENCES

1. *Sharma, Brij Kishore, " Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.*
2. *U.R.Gahai, " (1998) Indian Political System ", New Academic Publishing House, Jalaendhar.*
3. *R.N. Sharma, " Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.*
4. *Yogendra Singh, " (1997) Social Stratification and Charge in India ", Manohar, New Delhi.*

1 . INTRODUCTION 5

Special and comparative features of German with English, Hindi and Tamil - German Alphabets, pronunciation.

2 . THEMA 10

Name, Land Wohnort - Studium, Beruf - Familie, Geschwister, Alter - Tagesablauf , termine - Einladung - Stellensuche, Berufswahl - Einkauf.

3 . GRAMMATIK 10

Personalpronomen, Verb, Wortstellung, Ort - Possessivpronomen, Verb - 'Sein' - Verb - 'Haben', Unbestimmter Artikel, Negation - 'Nicht' - 'Kein' - Zeit, Bestimmter Artikel, Starke Verben - Trennbare Verben, Imperativ - Modal Verben - Akkusativ.

4 . UEBUNGEN 10

Partner uebungen - Schriftliche Uebungen - Aussprache Uebungen - Kontrollue bungen - Text generation.

5 . DIALOGUE 5

Oral - Written.

6 . GLOSSARY 5

Technical Words.

7 . TUTORIAL 15

Total No of periods: 60

Text Book:

1. LERNZIEL DEUTSCH (Deutsch als Fremdsprache) - Grundstufe 1 from Max Hueber varlag.

Text Book:

1. LERNZIEL DEUTSCH (Deutsch als Fremdsprache) - Grundstufe 1 from MAX Hueber Verlag.

1 . 9

Introduction to Japanese Alphabets - Hiragana, Katakana and Kanji - group 1,2,3 & 4 Syllabus - Writing Practice - Pronunciation - word Order - Greetings - Receiving a visitor and exchange of pleasantries - Kanji Practice.

2 . 9

Basic structure of sentences - classification of verbs - Polite form of verbs - irregular verbs - Particle-E - Time expressions - question sentences - Japanese numerals - Kanji practice.

3 . 9

Classification of particles - Ga, Ka, Wa, O, E, Ni etc - aural comprehension - reading comprehension - noun -1 Wa, noun -2 desu - Demonstrative pronouns - kore, sore , are and dore - kono, sono, ano and dono - kochira - sochira - achira and dochira - particle - No, kara, ni and de - question - itsu - conversational grammar - soo desu ka - Na, I adjectives perfect and imperfect - question words - Doo and ikaga - particle - To, ne and yo - Kanji practice.

4 . 9

Desu as a substitute for a verb - demonstrative pronouns sono and sore - Group 1 particles - de, O, Made and Ka - conjunction - soshite - Question words - dare, nani, doko, itsu, dore, dochira, doyatte, ikutsu, ikura - Words for degrees - gurai or kurai - Phrase - Saa - anoo - numerals - counters and numbers - humble form of desu and arimasu - Kanji practice.

5 . 9

Verbs ending in-te or de - classification of Te forms and Masu forms - verb modifiers - koo, soo, aa and doo - Set phrase - Onegaishimasu - Sumimasen - Adverbs - Mazu, sore kara and saigo ni - formation of the Te form of I adjective and desu - kanji practice.

Total No of periods: 45

Text Books:

1. *OOTSUBO et al - " A Course in Modern Japanese ", Vol.1, 1983, The University of Nagoya Press, Japan.*
2. *SHIYO SUZUKI and IKUO KAWASE - Nihongo Shoho text book with audio tapes, 1981.*
3. *YAN - SAN Serial - Video tapes, Japan.*

1 .	9
<p>Demonstrative Pronouns: Are - Interjection: Ee - Quoted Sentences - omoimsu - Non polite form of verbs - Group 1 ending in -ert or iru, group 2 verbs ending in - u - Non polite forms of - I - adjectives -non polite form of desu,deshoo,daroo - Suffic - Sugiru - expression of reason - tame (ni) - Counters: - Hon and - Do - Kanji practice.</p>	
2 .	9
<p>Negative - Te - form of verbs -I adjectives - Permission and prohibition - te mo desuka and - te wa ikemasen ka - Na - adjectives - suki and kirai - Verbs:Itadaku - Conjunction - Nagara - Phrase - No koto na n desu ga - usage of chotto - kanji practice.</p>	
3 .	9
<p>Noun modifiers - Quoting modifier - Suffix - Kata - sa and me - Particles - Made ni and dake - te form of verb and iru/imasu - noun - Uchi - Eba form of verbs - Kanji practice.</p>	
4 .	9
<p>Potential sentences - group 1 verbs - group 2 verbs irregular verbs - Nouns - Tsumori and Hazu - Adverbs: Moo and Made - Form of address: moshomoshi - Expression - Ee - verbs: Naru and suru - Particles - De and ka - kanji practice.</p>	
5 .	9
<p>Comparative sentences - no hoo ga and yori - Negative comparative sentences - Negative request - Adverbs of extent - Konna ni, sonna ni and anna ni - Te form of transitive verb and - arul - Passive sentence - neutral passive sentence - technical vocabulary related to Engineering and Technology - Preparation of technical reports.</p>	
6 . TUTORIALS	15

Total No of periods: 60

Text Books:

1. *OOTSUBO ET AL - " A Course in Modern Japanese ", Vol.II, The University of Nagoya Press, Japan, 1983.*
2. *SHIYO SUZUKI and IKUO KAWASE - Nihongo Shoho text book with audio tapes, The Japan Foundation, Tokyo, Japan, 1981.*
3. *YAN - SAN Serial - Video tapes, Japan.*

1 .	9
Alphabets - Pronunciation - Masculine and Feminine Genders only - Numbers - Indefinite and definite articles - plurals - Verbs to be and to have.	
2 .	9
Present tense - Affirmative, interrogative and negative sentences - Adjectives - Adverbs - Prepositions - Possessive Pronoun - Personnel Pronoun - Indirect Object.	
3 .	9
Group I verbs - Conjugations - Present, Past compound, Simple past and future tenses - Singular & Plural - Masculine and Feminine - adjectives and adverbs.	
4 .	9
Group II Verbs - Conjugations- Present, Past compound, simple past and future tenses - Singular and Plural - Masculine and Feminine - adjectives and adverbs.	
5 .	9
Pronominal verbs - Present, Past compound, Simple past and future tenses - Singular and Plural - Masculine and Feminine - adjectives - adverbs - Dialogue - Glossary.	
6 . TUTORIAL	15

Total No of periods: 60

Text Books:

1. MAUGER. G - *Course de Langue et de - Civilization Francaises*, HACHETTE -PARIS, 1986.
2. DOMINIQUE BERGER and REGINE MIRIEUX, *Cadences, Method de Francais Didier*, Paris, 1994.

References:

1. DENIS GIRARD, *French to English, English to French Dictionary*, Cassell - Mac Millan, 1981.

HS040 Technical French II**3 1 0 100**

1 .	9
Group III Verbs - Conjugations - Adjectives - Adverbs - sentences - present - past compound - Simple past - future.	
2 .	9
Comparative, superlative sentences - recent past - immediate future - grammatical analysis.	
3 .	9
Translation from English to French - Translation from French to English - Texts from Physics and Chemistry.	
4 .	9
Translation from English to French - Translation from French to English - Texts from Basic Engineering.	
5 .	9
Report writing and translation from English to French - Translation from French to English - Letter Writing - Dialogue - Glossary.	
6 . TUTORIALS	15

Total No of periods: 60

Text Books:

1. MAUGER, G - *Cours de Langue et de - Civilization Francaises*, HACHETTE - PARIS, 1986.
2. DOMINIQUE BERGER and REGINE MIRIEUX, *Cadences Methods de Francais*, Didier, Paris, 1994.

References:

1. CENTRE D'ETUDES FRANCAISES, " *Functional French for Scientists and Technologists* ", Jawaharlal Nehru University, New Delhi, 1986.
2. J.O.KETTRIDGE " *Dictionary of Technical terms and phrases Vol 1 & 2* ", The Gresham Press, Surrey, Great Britain, 1980.

1 . LISTENING 7

Listening comprehension-listening for specific information-note-taking-use of charts and diagrams.

2 . SPEAKING 7

Defining-describing objects-describing uses/functions-comparing-offering suggestions-analysing problems and providing solutions-expressing opinions (agreement/disagreement) predicting-expressing possibility/certainty-framing questions-providing answers-pronunciation practice (word stress).

3 . READING 12

Skimming-scanning-detailed reading-predicting content-interpreting charts and tables-identifying stylistic features in texts - evaluating texts-understanding discourse coherence-guessing meaning from the context- note - making / transferring information.

4 . WRITING 12

Sentence definition-static description-comparison and contrast-classification of information-recommendations-highlighting problems and providing solutions-formal and informal letter writing-using flow-charts/diagrams-paragraph writing-editing.

5 . FOCUS ON LANGUAGE 7

Word formation with prefixes and suffixes-discourse markers and their functions-degrees of comparison-expressions relating to recommendations and comparisons-active and passive voice-antonyms-tense forms-gerunds-conditional sentences-modal verbs of probability and improbability-acronyms and abbreviations - compound nouns and adjectives-spelling-punctuation.

6 . PRACTICE IN LANGUAGE LAB 15

Pronunciation practice - word stress - sentence stress - Listening comprehension - discussion - interpretation of visuals.

Total No of periods: 60

Text Books:

1. "*English for Engineers and Technologists* ", Volume I. Authors : *Humanities and Social Science Department, Anna University, Published by Orient Longman Ltd., 1990.*

References:

1. *Narayanaswami, V.R. Strengthen Your Writing, Orient Longman Ltd., Chennai 1996 (Revised Edition)*
2. *Pickett and Laster, Technical English, Writing, Reading and Speaking, New York Harper and Row Publications.*
3. *Swan, Michael, Basic English Usage, Oxford University Press, 1984.*

1 . LISTENING 7

Listening comprehension - listening for specific information - note-taking and using non-verbal devices.

2 . SPEAKING 7

Describing processes-stating purpose-offering opinions, suggestions and recommendations-summarizing-reporting-free discussion of chosen topics-pronunciation practice (word stress, consonant clusters-homonyms)

3 . READING 12

Skimming-scanning-note -making-understanding the organisation of texts discourse cohesion-predicting and evaluating content-evaluating style-inferring meaning-study reading-interpreting tables, flow-charts.

4 . WRITING 12

Extended definition-process description-cause and effect analysis-stating choice and justifying it -safety instructions-check list-letter of application-data sheet/resume.

5 . FOCUS ON LANGUAGE 7

Word formation-synonyms-prepositions-adverbs-passive voice-sequence words/discourse markers-connective adverbs-numerical expressions-expansion of abbreviations-rules for writing SI units-language of instructions, check-lists, causes and effects, purpose and means-indefinite adjectives of number and quantity-spelling and punctuation.

6 . PRACTICE IN LANGUAGE LABORATORY

Pronunciation practice - listening comprehension - discussion - interpreting and reporting from visual inputs.

7 . TUTORIAL 15**Total No of periods: 60**

Text Books:

1. *" English for Engineers and Technologists ", Volume II, AUTHORS :Humanities and Social Science Department, Anna University, Published by Orient Longman Ltd.,1990.*

References:

1. *Swales, John.M. and Christine B Feak, "Academic Writing for graduates students", The University of Michigan Press, USA, 1994.*
2. *Goddard, Ken - " Informative Writing - Your Practical Guide to Effective Communication ", Cassell Publication U.K. 1998.*
3. *Cutts, Martin " The Plain English guide-How to write clearly and Communicate Better ", Oxford University Press, New Delhi, 1995.*

1 . UNIT I 22

ORAL COMMUNICATION - Practical use of language in simulated real - life situations through role playing - social skills - interaction with employers, peers and subordinates - Group dynamics - Listening techniques - Phonological aspects of language use - pronunciation, stress and intonation.

Introducing oneself and others, narrating events - Making telephonic conversation - Making requests, Asking questions, Making recommendations using modal verbs, Expressing causal relations with suitable discourse markers, Giving instructions using imperatives, Expressing purposes and functions, obligation and preferences, Accepting offers and Counselling, Interpreting advertisements, Describing processes using sequential expressions. (Lecture:8, Practicals 14)

2 . UNIT II 12

Presenting one's ideas at meetings and conferences, Making extempore talks, Public speaking, Body language, Strategic competence, Use of audio - visual aids and multimedia presentations. (Lecture : 6, Practical 6)

3 . UNIT III 8

Technical Writing - the structure of organised writing - paragraph writing, coherence, cohesion (use of Discourse Markers) and punctuation, Use of titles, nonverbal devices - Layout - Revision strategies - Reading techniques.

Letter Writing: - Personal/Informal letters: Letters to family members and friends Business / Formal letters: Letters thanking the recipients, announcing functions, extending invitations, congratulating associates on important occasions, letters of application (Resumes), apology and complaint, letters to the editor. (Lecture:8, Practical : 0)

4 . UNIT IV 8

Report Writing: - persuasive, explanatory, argumentative and informative, Writing agenda, minutes, memos, project proposals and checklists.

(Lecture : 8, Practical 0)

5 . UNIT V 10

Grammar - study of grammatical items in contexts. Nouns, pronouns, adjectives, comparative adjectives, adverbs, gerund, prepositions, voice, tenses, 'if clauses, direct and indirect speech (reporting verbs), concord Vocabulary - Synonyms, antonyms, homonyms, homophones, hyponyms, affixes, reference words, phrasal verbs and prepositional phrases. (Lecture:10, Practical : 0)

Total No of periods: 60

Text Books:

1. *Doff, Adrian and Jones, Christopher, Language in Use: Classroom Book (Intermediate level). Cambridge: CUP. 1994 (2 audio cassettes).*
2. *Dr.V.Chellammal, Learning to Communicate - a resource book for Engineers and Technologists. Coimbatore: Kamakhya Publications 2002 (1 audio cassette)*

References:

1. *Sung, Abraham. 330 more Model Letters for all occasions Malaysia-Minerva Publications. 2002.*
2. *Bentley, T.J. Report Writing in Business: The Effective Communication of Information. New Delhi: Viva Books Pvt.Ltd., 2001*
3. *Vivanilam, J.V. More Effective Communication: A Manual for Professionals. New Delhi: Response Books. 2000*
4. *Michael, V.P.Communication and Research for Management. Mumbai: Himalaya Publishing House 2001.*
5. *Nauheim, Ferd. How to Write Business Letters. New Delhi; Crest Publishing House 2000.*
6. *Mohan, Krishna, Meera Banerji. Developing Communication Skills. New Delhi: Macmillan 1991.*
7. *Denny, Richard. Communicate to Win. New Delhi: Kogan Page 2002.*