CH034 Fertilizer Technology	**3**	**0**	**0**	**100**

1 . AN OVERVIEW **3**

Role of organic manures and chemical fertiliser, types of chemical fertiliser, growth of fertiliser in India; their location; energy consumption in various fertiliser processes; materials of various fertiliser processes; materials of consumption in fertiliser industry.

2 . NITROGENOUS FERTILISERS **15**

Feed stock for production of ammonia-natural gas, associated gas, coke-oven gas, naphtha, fuel oil, petroleum heavy stock, coal, electricity etc; processes for gasification and methods of production of ammonia and nitric acid; nitrogenous fertiliser-ammonium sulphate, nitrate, urea and calcium ammonium nitrate; ammonium chloride and their methods of production, characteristics and specifications, storage and handling.

3 . PHOSPHATIC FERTILISERS **9**

Raw materials; phosphate rock, sulphur; pyrites etc., processes for the production of sulphuric and phosphoric acids; phosphates fertilisers - ground rock phosphate; bone meal-single superphosphate, triple superphosphate, triple superphosphate, thermal phosphates and their methods of production, characteristics and specifications.

4 . POTASSIC FERTILISERS **5**

Methods of production of potassium chloride, potassium schoenite, their characteristics and specifications.

5 . COMPLEX AND NPK FERTILISERS **5**

Methods of production of ammonium phosphate, sulphate diammonium phosphate, nitrophosphates, urea, ammonium phosphate, mono-ammonium phosphate and various grades of NPK fertilisers produced in the country.

6 . MISCELLANEOUS FERTILISERS **5**

Mixed fertilisers and granulated mixtures; biofertilisers, nutrients, secondary nutrients and micro nutreints; fluid fertilisers, controlled release fertilisers, controlled release fertilisers.

7 . POLLUTION FROM FERTILISER INDUSTRY **3**

Solid, liquid and gaseous pollution standards laid down for them.

Total No of periods: 45

CH034 Fertilizer Technology **3 0 0 100**

References:

1. *" Handbook of fertiliser technology ", Association of India, New Delhi, 1977.*
2. *Menon, M.G.; " Fertiliser Industry - An Introductory Survey ", Higginbothams Pvt. Ltd., 1973.*
3. *Sauchelli, V.; " The Chemistry and Technology of Fertilisers ", ACS MONOGRAPH No. 148, Reinhold Publishing Cor. Newyork, 1980.*
4. *Fertiliser Manual, " United Nations Industrial Development Organisation ", United Nations, Newyork, 1967.*
5. *Slack, A.V.; Chemistry and Technology of Fertilisers, Interscience, Newyork, 1966.*

CH035 Petrochemical Technology **3 0 0 100**

1 . IMPORTANCE AND GROWTH **2**

Importance of petrochemical industry; Growth in India, Economics.

2 . PETROCHEMICAL PRECURSORS **10**

Principal raw materials and their sources; petrochemical precursors and their production methods - methane synthesis gas - ethane, ethylene, acetylene, propane - propylene, butane, butylenes, pentane and pentenes; - benzene, toluene - xylenes - napthalenes

3 . CHEMICALS FROM METHANE AND SYNTHESIS GAS **4**

Ammonia. oxo products - methanol - formaldehyde, chlorinated methanes; carbon-di-sulphide; hydrogen cyanide.

4 . CHEMICALS FROM ETHANE, ETHYLENE AND ACETYLENE **9**

Synthetic ethanol; acetaldehyde and acetic acid; vinyl acetate; butraldehyde; 2-ethyl hexanol and dop; ethylene oxide; ethylene glycols; acrylonitrile; polyethers; ethanolamines; ethylchloride; ethylene dichloride; vinyl chloride; ethylbenzene; styrene.

5 . CHEMICALS FROM PROPANE AND PROPYLENE **5**

Isopropanol; acetone; glycerol; propyleneoxide; propylene glycols; polyethers; acetylchloride; epichlorohydrine, isopropane, cumene.

6 . CHEMICAL FROM BUTANES, BUTENES, PENTANES AND PENTENES **5**

Butadiene; butane epoxides and butanolamines butanol; butyl acetate; methyl ethyl ketone; isoprene; amyl alcohol.

7 . CHEMICAL FROM AROMATICS **10**

Mono-chloro and dichlorobenzene; BHC; nitrobenzene; phenol; aniline; dodecyl benzene; benzaldehyde; benzoic acid; nitrotouene; toluene diamines and toluene disocyanate; phthalic anhydride; isophathalic acid, terephthalic acid and dimethyl terepthalic; maleic anhydride; caprolactum; adipic acid; hexamethylene, diamine

Total No of periods: 45

CH035 Petrochemical Technology **3** **0** **0** **100**

References:

1. Hahn, A.V.G.; " The Petrochemical Industry ", McGraw Hill, 1970.
2. Waddams, A.L.; " Chemicals from Petroleum ", Chemical Publishing Co., 1969.
3. Popchiev, A.V.; Naigyev M.F.; Shakhakhttinskii T.N.; " Synthetic Materials from Petroleum ", Pergamon Press, London, 1963.

CH036 Drugs and Pharmaceutical Technology **3 0 0 100**

1 . INTRODUCTION **2**

Development of drugs and pharamaceutical industry; organic therapeutic agents uses and economics.

2 . DRUG METABOLISM AND PHARMACO KINETICS **5**

Drug metabolism; physico chemical principles; radio activity; pharma kinetics-action of drugs on human bodies.

3 . IMPORTANT UNIT PROCESSES AND THEIR APPLICATIONS **9**

Chemical conversion processes; alkylation; carboxylation; condensation and cyclisation; dehydration, esterification, halogenation, oxidation, sulfonation; complex chemical conversions fermentation.

4 . MANUFACTURING PRINCIPLES **8**

Compressed tablets; wet granulation; dry granulation or slugging; direct compression, tablet presses formulation; coating pills; capsules sustained action dosage forms; parential solutions, oral liquids; injections; ointments; standard of hygiene and manufacturing practice.

5 . PHARMACEUTICAL PRODUCTS **8**

Vitamins; cold remedies; laxatives; analgesics; nonsteroidal contraceptives; external antiseptics; antacids and others.

6 . MICROBIOLOGICAL AND ANIMAL PRODUCTS **6**

Antibiotics; biologicals; hormones; vitamins; preservation.

7 . PHARMACEUTICAL ANALYSIS **5**

Analytical methods and tests for various drugs and pharmaceuticals.

8 . PACKING AND QUALITY CONTROL **2**

Packing; packing techniques; quality control.

Total No of periods: 45

CH036 Drugs and Pharmaceutical Technology **3 0 0 100**

References:

1. Rawlines, E.A.; " Bentleys Text book of Pharmaceutics ", III Edition, Bailliere Tindall, London, 1977.
2. Yalkonsky, S.H.; Swarbick. J.; " Drug and Pharamaceutical Sciences ", Vol.I, II, III, IV, V, VI and VII, Marcel Dekkar Inc., Newyork, 1975.
3. " Remingtons Pharmaceutical Sciences ", Mack Publishing Co., 1975.

CH037 Polymer and Plastics Technology **3 0 0 100**

1 . INTRODUCTION TO POLYMERS **15**

Monomer; functionality and degree of polymerisation; polymers and their classification; polymer coatings; adhesive rubber; plastic and fibres; distinction; polymeric reaction; addition; condensation and copolymerisation. Methods of polymerisation - bulk, solution, emulsion and suspension polymerisations; structure of polymers linear, branched and cross linked; characterization of polymers; molecular weight, crystallinity, glass transition and mechanical properties; testing of polymers, destructive and non destructive methods.

2 . PROCESSING OF PLASTICS **10**

Processing additives; fillers, plasticisers; anti-oxidants; colourants; stabilisers and other related additives. Injection; compression transfer and moulding methods calendaring; extrusion; thermoforming; powder coating.

3 . POLYMERIC MATERIALS **13**

Polyethylene; poly propylene; polystyrene, polymethyl methacrylate; polyvinyl chloride; polytetra fluoro ethylene; polyacrylate; nylon 6, nylon 6,6 and polyesters; Phenol formaldehyde, urea formaldehyde, and melamine formaldehyde; epoxy; urethanes and silicones.

4 . SPECIAL POLYMERS **5**

Polycarbonates; poly sulphones; aromatic polyamides; aromatic polyester; photo conductive, piezoelectric and ion exchange polymers.

5 . NATURAL POLYMERS **2**

Wool, silk and cellulose derivatives.

Total No of periods: 45

CH037 Polymer and Plastics Technology **3 0 0 100**

References:

1. Miles, D.C.; Briston, J.H.; " Polymer Technology ", Chemical Publishing Co., Inc. New York, 1979.
2. Rodriguez, F.; " Principles of Polymer systems ", McGraw-Hill, New York, 1971.
3. Williams, D.J.; " Polymer Science and Engineering ", Prentice Hall, New York, 1971.

CH038 Food Technology **3 0 0 100**

1 . AN OVERVIEW **1**

General aspects of food industry; world food needs and Indian situation.

2 . FOOD CONSTITUENTS, QUALITY AND DERIVATIVE FACTORS **9**

Constituents of food; quality and nutritive aspects; food additives; standards; deteriorative factors and their control.

3 . GENERAL ENGINEERING ASPECTS AND PROCESSING METHODS **4**

Preliminary processing methods; conversion and preservation operations.

4 . FOOD PRESERVATION METHODS **16**

Preservation by heat and cold; dehydration; concentration; drying irradiation; microwave heating; sterilisation and pasteurisation; fermentation and pickling; packing methods.

5 . PRODUCTION AND UTILISATION OF FOOD PRODUCTS **15**

Cereal grains; pulses; vegetables; fruits; spices; fats and oils; bakery; confectionery and chocolate products; soft and alcoholic beverages; dairy products; meat; poultry and fish products.

Total No of periods: 45

CH038 Food Technology **3 0 0 100**

References:

1. Heid, J.L; Joslyn, M.A., " Fundamentals of Food Processing Operation ", The AVI Publishing Co., Westport, 1967.
2. Potter, N.N.; " Food Science ", The AVI Publishings Co., Westport, 1963.
3. Heldman D.R.; " Food Process Engineering ", The AVI Publishing Co., Westport, 1975.
4. Charm, S.E.; " The Fundamentals of Food Engineering ", The AVI Publishing Co., Westport, 1963.

CH039 Surface Coating Technology **3 0 0 100**

1 . PREPARATION OF PIGMENTS; WHITE PIGMENTS **14**

Red pigments; orange and yellow pigments; green, blue and black pigments.

2 . DRYING OILS AND DRIERS; SOLVENTS AND PLASTICISERS **16**

Resins, gums; waxes and bitumens, varnishes and lacquers; paints and enamels; cellulose ester products; synthetic resins and finishers; paint chemistry.

3 . **15**

Paints plant; varnish plant; manufacture operation; factory cost accounting; research, development and control; fire protection; safety and health.

Total No of periods: 45

References:

1. *Noel Heaton; " Outlines of Paint Technology ", Charles Griffin and Co., Ltd., W.C.2. 1976.*
2. *Morgans, W.M.; " Outlines of Paint Technology ", Vol.I, Charles Griffin and Co., W.C.2., 1976.*
3. *Bidlack, C; Edgar W.Pasig; " Paints and Varnish Production Manual ", Chapman & Hall Ltd., New York, 1978.*
4. *Turner, G.P.A.; " Introduction to Paint Chemistry and Principles of Paint Technology ", Oxford & IBH Pub.Co. 1980.*

CH040 Electrochemical Engineering **3 0 0 100**

1 . BASICS OF ELECTROCHEMISTRY **3**

Faraday's law; Nernst potential; galvanic cells; polarography.

2 . THE ELECTRICAL DOUBLE LAYER **3**

It's role in electrochemical processes; electrocapillary curve; Helmholtz layer; Guoy-Steven's layer; fields at the interface.

3 . METAL FINISHING **6**

Electrodeposition; electrorefining; electroforming; electropolishing; anodising; selective solar coatings.

4 . ELECTROCHEMICALS **6**

Inorganic; perchlorates; chlorates; permanganates; persulphates. Organic; p-Aminoguanidine bicarbonate; dialdehyde starch; calcium gluconate etc.

5 . ELECTRODES USED IN DIFFERENT ELECTROCHEMICAL INDUSTRIES **4**

Metals; Graphite; lead dioxide; titanium substrate insoluble electrodes; iron oxide; semiconducting type etc.

6 . BATTERIES **6**

Primary and secondary batteries; Leclanche drycell; Alkaline manganese cell; mercury cell; airdepolarised cell; sea-water cell; reserve electrolyte cells like Mg-Cucl 2; Zn-PbO 2; Secondary cells like lead acid; Ni-Cd; Ni-Fe; AgO-Zn; AgO-Cd. Sodium Sulphur; Li-S; Fuel cells.

7 . ELECTROMETALLURGY **5**

Fused salt electrolysis for Al, Na, Mg, etc., CaC 2, hydrometallurgy Zn, Cu, Pd etc.

8 . CORROSION **8**

Introduction, metallic surface preparation; phosphating; inhibitors in acid media; in engine cooling systems; control measures; industrial boiler water corrosion control; protective coatings, vapour phase inhibitors; cathodic protection; sacrificial anodes; paint removers.

9 . CHLOROALKALI INDUSTRY **4**

Electrodes used; membranes, electrical efficiency; modern trends.

Total No of periods: 45

CH040 Electrochemical Engineering **3** **0** **0** **100**

References:

1. Newman, J.S; " Electrochemical Systems ", Prentice-Hall Inc., 1973.
2. Mantel, C; " Electrochemical Engineering ", McGraw-Hill, 1972.
3. Kuhn, A.T.; " Industrial Electrochemical Process ", Elsevier Publishing Co., 1971.

CH041 Environmental Engineering **3 0 0 100**

1 . POLLUTANTS AND ITS EFFECTS **15**

Sources of air pollution; effect of air pollution on the environment; on materials, on human health, on animals; meteorological effects; visibility factors.

2 . LEGISLATIVE ASPECTS AND MANAGEMENT **5**

Legislative and regulatory trends; air pollutants; waste water treatment and recycle.

3 . INDUSTRIAL WASTE AND EFFLUENT TREATMENT **10**

Gaseous, solid, liquid waste disposal, air pollution considerations in soild and liquid waste disposal.

4 . ANALYSIS AND CONTROL **15**

Analytical techniques in air pollution; design aspects of pollution control systems.

Total No of periods: 45

References:

1. Ross, G.R.D.; " Air Pollution and Industry ", VanNostrand Reinhold Co., New York, 1972.
2. Kozirowski, B; Kucharske, J; " Industrial Waste Disposal ", Pergamon Press, 1972.
3. Stern A.C.; Boubce R.W.; Lowry W.P. " Fundamentals of Air Pollution ", Academic Press, 1973.

CH042 Biochemical Engineering **3 0 0 100**

1 . CONVENTIONAL CHEMICAL PROCESSES AND BIOCHEMICAL PROCESSES **4**

An overview of industrial biochemical processes with typical examples, comparing chemical and biochemical processes, development and scope of biochemical engineering as a discipline.

2 . ROLE OF MICROORGANISMS **3**

Industrially important microbial strains; their classification; structure; cellular genetics; typical examples of microbial synthesis of biologicals.

3 . ENZYMES AND ENZYME KINETICS **8**

Enzyme used in industry medicine and food, Their classification with typical examples of industrially important enzymes; Mechanism of enzymatic reactions; Michaelis-menten kinetics; enzymes inhibition; factors affecting the reaction rates; industrial production purification and immobilisation; enzyme reactors with typical examples.

4 . MICROBIAL KINETICS **8**

Typical growth characteristics of microbial cells; factors affecting growth; Monod model; modelling of batch and continuous cell growth; immobilised whole cells and their characteristics; free cell and immobilised cell reactors; typical industrial examples; transport in cells

5 . TRANSPORT IN MICROBIAL SYSTEMS **6**

Newtonian and Non-Newtonian behaviour of broths; agitation and mixing; power consumption; gas/liquid transport in cells; transfer resistances; mass transfer coefficients and their role in scaleup of equipments; enhancement of O2 transfer; heat transfer correlation; sterilisation cycles and typical examples of heat addition and during biological production.

6 . BIOREACTORS **8**

Batch and continuous types; immobilised whole cell and enzyme reactors; high performance bioreactors; sterile and non-sterlie operations; reactors in series with and without recycle; design of reactors and scaleup with typical examples.

7 . DOWNSTREAM PROCESSES AND EFFLUENT TREATMENT **8**

Different unit operations in down streaming with special reference to membrane separations; extractive fermentation; anaerobic treatment of effluents; typical industrial examples for downstream processing and effluent disposal.

Total No of periods: 45

CH042 Biochemical Engineering **3** **0** **0** **100**

References:

1. *Bailey, J.E.; Ollis, D.F.; " Biochemical Engineering Fundamentals ", McGraw-Hill, New York, 1972.*
2. *Aiba, S,; Humphery, A.E.; Milli, N.R.; " Biochemical Engineering 2nd ed. ", Academic Press, 1973.*
3. *Web, F.C.; " Biochemical Engineering ", Van Nostrand, 1964.*
4. *Atkinsono, B.; " Biochemical Reactors ", Pion Ltd., 1974.*

CH043 Biomedical Engineering **3 0 0 100**

1 . INTRODUCTION TO PHYSIOLOGY **5**

Cell and its function; nervous system; cardio vascular system; respiratory system; renal physiology.

2 . BIOELECTRIC PHENOMENA **5**

Basis of bi po tentials; principles of ECG, EEG, EMG.

3 . ANALYSIS OF SOME MONITORING-DIAGNOSTIC THERAPEUTIC PROCEDURES **3**

Introduction to biochemical; biodynamic models and its application; cardiac assist devices; biomechanics of head injury.

4 . MEDICAL INSTRUMENTATION **3**

Amplifier constraints and specification; recording systems; electrial grounding and patient safety; transducers; electrodes for recording biopotentials.

5 . ANALYSIS OF BIOELECTRICAL SIGNALS **3**

Introduction; data acquisition; extraction of signals from noise; introduction to pattern recognition.

6 . PHYSIOLOGICAL CONTROL SYSTEMS **3**

Regulation of body temperature; recognition and control in the CV system.

7 . MEDICAL PHYSICS **3**

Rheology of blood; radiation dosimetry; neutron activation analysis; safety procedures for radiation diagnostics; ultra sound effects.

8 . BIOPOLYMERS **4**

Introduction; nature and composition of polymers used as prosthetic devices with special reference to heart valves; artificial bones; denatures; autures etc.

9 . TRANSPORT PHENOMENA IN HUMAN BIOLOGY **6**

Introduction to renal and respiratory system; lung oxygenator and their design characteristics; artificial kidney and their deign features.

10 . MEDICAL ENZYMOLOGY **5**

Role of enzyme in clinical tests; their role as therapeutic agents; Role of enzyme electrodes in chemical testing; extra corporeal shunts using Immoblished enzymes.

11 . RECENT TRENDS IN MEDICAL FIELD **5**

Total No of periods:

CH043 Biomedical Engineering **3 0 0 100**

Role of computer in medical data logging and diagnosis; CAT and NMR scanning; transplants; introduction to aviation and space medicine specially drugs and their mode of action.

45

References:

1. Brown, E, ; " Biomedical Engineering ", Davis Philadelphia USA, 1971.
2. Kennedy, K, ; " Advances in Biomedical Engineering ", Academic Press, 1970.

CH044 Process Automation **3 0 0 100**

1 . INTRODUCTION **9**

Principles of measurement and classification of process control instruments; temperature, pressure fluid flow, liquid level, velocity, fluid density, viscosity, conductivity etc., instrument scaling; sensors; transmitters and control valves; instrumentation symbols and labels.

2 . PROCESS AUTOMATION **9**

Basic concepts; terminology and techniques for process control; control modes; Tuning process controllers.

3 . ADVANCED CONTROL **9**

Advanced control techniques, feed forward and ratio control; controller design; adaptive control system; statistical process control; expert system; multivariable control techniques; supervisory control.

4 . DIGITAL CONTROL **9**

Digital control techniques; z transforms; sampling and filtering; response of discrete time systems; sampled data control systems; design of digital controllers.

5 . OPTIMAL CONTROL **9**

Optimisation and simulation; optimisation techniques; single and multivariable constrained optimisation; dynamic simulation of distillation columns and reactors.

Total No of periods: 45

CH044 Process Automation **3 0 0 100**

References:

1. *Nakara, B.C.; Choudary, K.K.; " Instrumentation and Analysis ", Tata McGraw Hill, New Delhi, Eigth Reprint, 1993.*
2. *Stephanopoulos, G.; " Chemical Process Control ", Tata McGraw Hill, New Delhi, 1993.*
3. *Karl J.Astrom, Bjorn Willermans; " Computer Controlled Systems ", Prentice Hall of India Pvt. Ltd., 1994.*
4. *Chemical Engineering Refresher Series on " Process Automation ", McGraw-Hill Publications, New York, 1991.*

CH045 Process Modelling and Simullation **3 0 0 100**

1 . BASIC MODELLING **8**

Introduction to modelling; uses of mathematical models; scope of coverage; principles of formation; review on algeberic, ordinary and partial differential equations; solutions of the above equations; linearisation; probabilisation models; development of models by experiment and statics; regression and correlation analysis.

2 . MATRIX MODELS **7**

Elementary matrix concepts; simple array models; multi-component distillation; dynamic simulation of distillation column; solution techniques for matrix differential equations; matrix formation of distributed parameter system; flow pattern in stirred tanks; design of mixers.

3 . LUMPED PARAMETER MODEL **8**

Introduction to lumped parameter system; mathematical description of multiphase transfer process; non isothernal reactors etc.; Axial dispersion in packed beds; reactor design from response curves; reactor effectiveness factor; computer aided modelling of reaction networks.

4 . DISTRIBUTED PARAMATER MODEL **8**

Formation and solution of one dimensional unsteady state problem in heat transfer and mass transfer systems; multidimensional problems; application in heat and mass transfer equipments.

5 . OPTIMISATION AND SIMULATIONS **14**

Introduction; application; analytical and numerical techniques for multivariable problems; techniques for constrained optimisation; simulation; introduction; discrete event and continuous simulation; dynamic simulation of reactors, distillation columns, absorbers, evaporators and crystallizers; simulation in process control.

Total No of periods: 45

CH045 Process Modelling and Simullation **3** **0** **0** **100**

References:

1. *Ramirez, W.; " Computational Methods in Process Simulation ", Butterworths Publishers, New York, 1989.*
2. *Edgar, T.F.; Himmelblau, D.M.; " Optimisation of Chemical Processes ", McGraw-Hill Book Co., New York, 1989, Wiley inter science, New York, 1972.*
3. *Luyben, W.L., " Process Modelling Simulation and Control ", McGraw-Hill Book Co., 1973.*
4. *Myers, A.L., Seider, W.D.; " Introduction to Chemical Engineering and Computer Calculations ", Prentice Hall Inc., Englewood Cliffs, New Jersey, 1976.*
5. *Chemical Engineering Refresher Series on " Process Dynamics ", McGraw-Hill Publications, 1983.*
6. *Mickley, H.S.; Sherwood, T.S.; Reed C.E.; " Applied Mathematics for Chemical Engineers ", Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1989.*

CH046 Optimisation of Chemical Processes **3 0 0 100**

1 . OPTIMISATION **8**

Introduction; formulation of objective functions; fitting models to data; classification of functions; necessary and sufficient conditions for optimum; unimodal, multimodal functions; analytical methods lagrange multiplier methods.

2 . NUMERICAL METHODS **19**

Unimodel functions; newton's quasi newton, secant methods; region elimination methods, polynomial approximation; quadratic and cubic interpolation techniques for optimum. Multimodal functions; direct methods; random, grid. hooke's nelder and mead methods; powell's technique; indirect methods; gradient and conjugate gradient methods; secant methods.

3 . LINEAR AND NON-LINEAR PROGRAMMING **10**

Review on basic concepts of LP formulations; Simplex methods; Integer, quadratic, geometric and dynamic programming.

4 . APPLICATIONS **8**

Heat transfer and energy conservation; separation processes; fluid flow systems; reactor design and operation; large scale systems.

Total No of periods: 45

References:

1. *Edgar, T.F., Himmelblau, D.M., " Optimisation of Chemical Processes ", McGraw-Hill Book Co., New York, 1985.*
2. *Reklaitis, G.V., Ravindran, A., Ragsdell, K.M. " Engineering Optimisation ", John Wiley, New York, 1980.*
3. *Biles, W.E., Swain, J.J.; " Optimisation and Industrial Experimentation ", Inter Science, New York, 1980.*
4. *Seinfeld, J.H.; Lapidus, L; " Process Modelling, Estimation and Identification ", Prentice Hall, Englewood Cliffs, New Jersey, 1974.*
5. *Beveridge, C.S.; Schechter, R.S.; " Optimisation: Theory and Practice ", McGraw-Hill Book Co., New York, 1970.*

CH047 Computer Aided Design **3 0 0 100**

1 . GENERAL PROCESSORS **4**

Introduction to central processors; historical approach analog register; output buffer; digital logic, CPU, ALU, Computer system architecture; I/O Remote access.

2 . DATA STORAGE **4**

Role of storage devices; main memory; backing storage; need for memory mapping; virtual addressing paging.

3 . ALPHA NUMERIC AND GRAPHIC I/O **8**

Batch and interactive processing; data input devices; data output devices; combination of i/o control devices; graphic computer terminals; graphic display; graphic terminals; graphic display; graphic terminal plotters; printers.

4 . BASIC SOFTWARE **4**

Operating system and executive operating system; function models of operation; batch operation; time sharing; real time operation; transaction processing; file management system; logging on and off; editors; database; graphic software.

5 . PROPERTIES EVALUATION **5**

Physical properties of compounds; thermodynamic properties of gases and binary mixtures; viscosity, vapour pressure, latent heat, bubble point and dew point calculation; phase equilibria; vapour-liquid equilibria.

6 . EQUIPMENT DESIGN **10**

Computer aided deign of reactors; evaporators; absorption column; distillation column and crystallizers; heat transfer equipment; heat exchangers, furnaces etc., pumps; piping; pressure drop calculations; mass and energy balance.

7 . FLOW SHEET SIMULATION **5**

Process flow sheet simulation; process and information matrix; recycle calculation sequence; material and energy balance computation using modular approach.

8 . DYNAMIC SIMULATION **5**

Dynamic simulation of reactors; distillation column; absorbers; evaporators and crystallizers; introduction to simulation packages like GPSS, CSMP.

Total No of periods: 45

CH047 Computer Aided Design **3** **0** **0** **100**

References:

1. Douglas, J.M., " Conceptual Design of Chemical Processes ", McGraw-Hill International Edition, 1988.
2. Liu, Y.A., Mcgree, H.A., Report N., " Recent Developments in Chemical Process & Plant Design ", John Wiley & Sons, New York, 1987.
3. Walas, S.M., " Chemical Process Equipment Design ", Butterworths, 1988.
4. Ross, G., " Computer Programming Examples for Chemical Engineers ", Elsevier, New York, 1988.
5. Ahson, S.I., " Microprocesses with Application in Process Control ", Tata McGraw-Hill, New Delhi, 1990.

CH048 Energy Management in Chemical Industries 3 0 0 100

1 . ENERGY RESOURCES - A GLOBAL VIEW 6

Energy sources; coal oil, natural gas; nuclear energy; hydro electricity, other fossil fuels; geothermal; supply and demand; depletion of resources of resources; need for conservation; uncertainties; national and international issues.

2 . PLANNING FOR ENERGY NEEDS 6

Forecasting techniques; energy demand; magnitude and pattern; input and output analysis; energy modelling and optimal mix of energy sources.

3 . ENERGY AND ENVIRONMENT 6

Energy; various forms; energy storage; structural properties of environment; bio-geo-chemical cycles; society and environment population and technology.

4 . ENERGY AND TECHNOLOGICAL SOCIETY 6

Energy and evolution; growth and change; patterns of consumption in developing and advances countries; commerical generation of power requirements and benefit.

5 . MANAGEMENT OF ENERGY CONSERVATION IN CHEMICAL INDUSTRIES 8

Chemical industries; classification; conservation in unit operation such as separation; cooling tower; drying; conservation applied to refineries, petrochemical, fertilisers, cement, pulp and paper, food industries, chloro-alkali industries; conservation using optimisation techniques.

6 . ENERGY ALTERNATIVES 6

Sources of continuous power; wind and water; geothermal; tidal and solar power; MHD, fuel cells; hydrogen as fuel.

7 . ECONOMIC BALANCE IN ENERGY CONSUMPTION 7

Cost analysis; capacity; production rate; system rate; system cost analysis; corporate models; production analysis and production using fuel inventories; input-output analysis; economics; tariffs.

Total No of periods: 45

CH048 Energy Management in Chemical Industries **3** **0** **0** **100**

References:

1. Jerrold H.Krentz; " Energy Conservation and Utilisation ", Allyn and Bacur Inc., 1976.
2. Gemand M.Gramlay; " Energy ", Macmillon Publishing Co., New York, 1975.
3. Rused C.K., " Elements of Energy Conservation ", McGraw-Hill Book Co., 1985.
4. Judson King; " Separation Processes ", McGraw-Hill Book Co., 1985.

CH049 Safety in Chemical Process Industries **3 0 0 100**

1 . INTRODUCTION **4**

Safety in industries; need for development; importance safety consciousness in indian chemical industry; social environmental setup; tolerance limit of the society; psychological attitude towards safety programmes.

2 . SAFETY PROGRAMMES **4**

Elements of safety programme; effective realisation economic and social benefits; effective communication training at various levels of production and operation.

3 . INDUSTRIAL SAFETY **8**

Chemical process industries; potential hazard; chemical and physical job safety analysis; high presssure; high temperature operation; dangerous and toxic chemicals; highly radioactive materials; safe handling and operation of materials and machineries; planning and layout.

4 . SAFETY PERFORMANCE **7**

Appraisal; effective steps to implement safety procedures; periodic inspection and study of plant layout and constant maintenance; periodic advice and checking to follow safety procedures; proper selection and replacement of handling equipments; personal protective equipments.

5 . ACCIDENTS **6**

Industrial accidents - accident costs - identification of accident spots; remedial measures; identification and analysis of causes of injury to men and machines - accident prevention - accident proneness - vocational guidance, fault free analysis. Fire prevention and fire protection.

6 . POLLUTION **6**

Atmospheric pollution - chemicals and dust - toxicity toxic materials and gases - environmental pollution by effluent and industrial wastes - treatment .

7 . HEALTH HAZARDS AND LEGAL ASPECTS **6**

Health hazards - occupational - industrial health hazards - health standards, and rules - safe working environments - parliamentary legislations - factories act - labour welfare act - ESI Act - Workmen Compensation Act.

8 . PROMOTION OF INDUSTRIAL SAFETY **4**

Role of Government, safety organisations, management and trade unions in promoting industrial safety.

Total No of periods: 45

CH049 Safety in Chemical Process Industries **3** **0** **0** **100**

References:

1. *William Handley, " Industrial Safety ", Hand Book McGraw-Hill Book Company 2nd Edition, 1969.*
2. *Fawatt, H.H. and Wood, W.S., " Safety and Accident Prevention in Chemical Operation ", Interscience, 1965.*
3. *Heinrich, H.W. Dan Peterson, P.E. and Nester Rood, " Industrial Accident Prevention ", McGraw-Hill Book Co., 1980.*
4. *Blake, R.P., " Industrial Safety ", Prentice Hall Inc., New Jersy - III Edition, 1963.*

CH050 Oils and Fats Technology **3 0 0 100**

1 . AN OVERVIEW **9**

General aspects of edible oils, oil seeds and fats technology; World requirement of oils and fats; Indian scenario.

2 . OILS AND FATS : CONSTITUENTS **9**

Constitution and Chemistry of oils and fats; Application of oils and fats; Fat substitutes.

3 . GENERAL ENGINEERING ASPECTS AND PROCESSING METHODS **9**

Recovery and Pretreatment of oils and fats; Analysis.

4 . OIL REFINING **9**

Physical treatment; Chemical Bleaching; Deodorizing; Wintering .

5 . HYDROGENATION **9**

Hydrogenation of oils in general; Equipment; Catalysts; Dry & Wet reduction. The Hardening operation; Hydrogenation products.

Total No of periods: 45

CH050 Oils and Fats Technology **3 0 0 100**

References:

1. *AUSTIN G.T., SHREVE'S " Chemical Process Industries ", Fifth Edition, McGraw-Hill International Book Company, Singapore 1984.*
2. *DRYDEN C.E., " Outlines of Chemical Technology ", Edited & Revised by Gopala Rao, M and M.Sittig, Second Edition, Affiliated East-West Press, 1993.*
3. *ROGER'S " Industrial Chemistry ", Edited by C.C.FURNAS*
4. *KENT J.A. (ed). Riegel's " Handbook of Industrial Chemistry ", Van Nostrand Reinhold, 1974.*

CH051 Bio Catalytic Reaction Engineering and Design **3 0 0 100**

1 . INTRODUCTION **5**

Classification of Biocataytic Reactors - Choice & Design Definition - General Methods - Phase of Design - Modeling - Data Collection - Mechanical Design Operating conditions.

2 . TYPES OF REACTORS & METHODS OF HANDLING BIOCATALYSTS **5**

Biocatalytics and Biokinetics - Bioreactions & Mechanisms - Biocatalysis and Activity - Biocatalytics preparation - Biocatalytic parameters - Biocatalytic Loading - Biocatalysis study - Data handling - half-life.

3 . MASS TRANSFER AND BIOCATALYTIC REACTORS **5**

BIOT.NO & FXTL Mass transfer - THIELE MODULUS & INTL Mass Transfer - IMMOBILISATION FACTOR - Estimation of Km & Interpretation.

4 . REACTOR CONSIDERATION **5**

Reactor operation & Methods - Special Applications - Choice based on kinetics and other factors - Cost Consideration.

5 . PROCESS DESIGN OF FIXED BED REACTOR **5**

General Design - GLS Reactors Definition and Classification - Transport in GLS Reaction and Design considerations.

6 . PROCESS DESIGN OF TRICKLE BED REACTORS **5**

General Procedure - Design examples - Variations.

7 . SUSPENDED BED REACTORS **5**

Chemostatic Operations - Process Design of Suspended Bed units - Fluidized Bed Kinetics.

8 . DESIGNING LAB REACTORS AND PILOT UNITS **3**

Definition - Lab Reactors - Pilot Units.

9 . REACTION EFFECTS AND SAFETY **2**

Causes of Hazards - Parameters of Biomass formation under high productivity - Bio safety - Clean Technology.

10 . MECHANICAL DESIGN OF REACTORS **5**

Design for a process - Design for Temperature control - Other considerations - Mante carlo costing.

Total No of periods: 45

CH051 Bio Catalytic Reaction Engineering and Design 3 0 0 100

References:

1. *M.Orhan Tarhan " Catalytic Reaction Design ", McGraw-Hill Book Co., New York, USA, 1983.*
2. *James M.Lee. " Biochemical Engineering ", Prentice Hall New York, USA, 1992.*
3. *H.W. Blanch & D.S.Clerk. Marcel & Dekker " Biochemical Engineering ", New York, USA, 1996.*
4. *MAVITUNA F & B.ATKINSON, " Biochemical Engineering ", HandBook (1980) Publishers.*
5. *Aibra S.A.E. Humptry & N.F. Mills " Biochemical Engineering (II Ed) ", Pp 242-246 Tokyo Japan, University of Tokyo Press 1973.*
6. *J.J. Carberry " Chemical and Catalystic Reaction Engineering ", New York McGraw-Hill (1976).*

CH052 Bio Geo Chemical Engineering **3 0 0 100**

1 . INTRODUCTION **2**

Biochemical Engineering - Bio geo Chemical Engineering Fermentation - Bio Process.

2 . ENZYME KINETICS **5**

Introduction - Nomenclature - Application - ENZYME KINETICS - M.M. Kinetics - Evaluation - Enzyme reactors - Inhibition - Effects on Enzyme activity.

3 . IMMOBILISED ENZYME **3**

Immobilisation - Effects on Immobilised catalysts - IMTR - INTR - EFF DIFFUSIVITIES.

4 . INDUSTRIAL APPLICATIONS **5**

For recovery of HM - For Resource Recovery - Kinetics for Process - Experiments - E. Assay - Sugar Assay - Protein Assay.

5 . CELL CULTIVATION **5**

Microbial cells - Fungi for Enzyme - Culture media - Examples - Cell Growth Studies - Measurement, Cellno - Cell Mass - Indirect Methods - Cell Immobilisation - Experiments - Growth Analysis Immobilisation & Characterisation.

6 . CELL KINETICS & FERMENTER DESIGN **5**

Introduction - Growth Cycle - LAG Phase - Factors of Growth - Other consideration - Multiple fermention - Alternative Fermenters - Models for growth Genetics & Application.

7 . STERILISATION **5**

Death Kinetics - Design criteria - Cont Sterilisation.

8 . AGITATION & AERATION **5**

Tr. Coeff. - Interfacial Atta Measurement - Gas HOLD UP - Power consumption - OTRATE & O 2 ESTIMATION - K l a CORRELATIONS -Shear - Scaleup.

9 . BIO ACCUMULATION & PRECIPITATION OF METALS **7**

Remavol of metals in industrial waste water - Mechanism Oxido reduction - Induction of Edzimes - Metal precipitation - Bio sorption In Liquidphase - Bio sorbents - Bio claim Technology - Case studies - bio Tansorption - Case studies - Metals - Case studies - Organics.

10 . PROBLEMS IN RECOVERY OF METALS WITH CHEMICAL ENGINEERING APPROACH **3**

Total No of periods: 45

CH052 Bio Geo Chemical Engineering **3** **0** **0** **100**

References:

1. J.M. Lee " Biochemical Engineering ", Prentice Hall, New York, USA, 1992.
2. " BioGeo Technology ", (Fax metals) Centre for Intl. Projects, Moscow (1988).
3. H.W.Blanch & D.W.Clerk " Biochemical Engineeing ", Marcel & Dekker New York, 1996.

GE034 Creativity, Innovation and New Product Development 2 0 2 100

1 . INTRODUCTION 8

The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brain storming - different techniques.

2 . PROJECT SELECTION AND EVALUATION 8

Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques).

3 . NEW PRODUCT DEVELOPMENT 7

Research and new product development - Patents - Patent search - Patent laws - International code for patents - Intellectual property rights (IPR).

4 . NEW PRODUCT PLANNING 7

Design of proto type - testing - quality standards - marketing research - introducing new products.

Total No of periods: 30

LABORATORY:

Creative design - Model Preparation - Testing - Cost evaluation - Patent application.

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

GE037 Intellectual Property Rights (IPR) 3 0 0 100

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.

GE038 Indian Constitution and Society **3 0 0 100**

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; Castle, 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

GE038 Indian Constitution and Society **3 0 0 100**

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.

HS035 Technical German I **3 1 0 100**

1 . INTRODUCTION **5**

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

2 . THEMA **10**

Name, Land Wohnort - Sudium, 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 urbungen - Sachriftliche 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

HS035 Technical German I	**3**	**1**	**0**	**100**

Text Book:

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

HS036 Technical German II **3 1 0 100**

1 . INTRODUCTION **5**

German Idioms and Phrases.

2 . THEMA **10**

Geschenke, auf der post - Auskunft - Fest - Heirat, Kinder - Studium - Ausbuilding - Erziehung, Jugend - Deutschsprachige Laender, Europa - Arbeitswelt, Urlaub.

3 . GRAMMATIK **10**

Ort and Richtung - Reflexive Verben, Verben mit Praepositional object - Perfect - Praeteritum - Adjective - Komparation, Genitic Wortbuildung - Nebensaetze.

4 . UEBUNGEN **10**

Partner uebungen - Schriftliche Uebungen - Aussprache Uebungen - Kontrolluebungen - Text Generation.

5 . DIALOGUE **5**

Oral - Written.

6 . GLOSSARY **5**

Technical Words.

7 . TUTORIALS **15**

Total No of periods: 60

HS036 Technical German II	**3**	**1**	**0**	**100**

Text Book:

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

HS037 Technical Japanese I **3 1 0 100**

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 - Demostrative pronouns - kore, sore , are and dore - kono, sono, ano and dono - kochira - sochira - achira and dochira - parcle - 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

HS037 Technical Japanese I **3 1 0 100**

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.

HS038 Technical Japanese II **3 1 0 100**

1 . 9

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.

2 . 9

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.

3 . 9

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.

4 . 9

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.

5 . 9

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.

6 . TUTORIALS 15

Total No of periods: 60

HS038 Technical Japanese II **3** **1** **0** **100**

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.*

HS039 Technical French I **3 1 0 100**

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**

Pronomial verbs - Presnet, 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

HS039 Technical French I **3 1 0 100**

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

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

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.

HS041 English I **3 1 0 100**

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

HS041 English I **3 1 0 100**

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.

HS042 English II **3 1 0 100**

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 pratice - listening comprehension - discussion - interpreting and reporting from visual inputs.

7 . TUTORIAL **15**

Total No of periods: 60

HS042 English II **3 1 0 100**

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.*

HS053 Communication Skills for Engineers **2 0 2 100**

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.
(Lectue:8, Practical : 0)

4 . UNIT IV **8**

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

(Lectuer : 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. (Lectuer:10, Practical : 0)

Total No of periods: 60

HS053 Communication Skills for Engineers **2 0 2 100**

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.

IB034 Technical Writing and Communication **3 0 0 100**

1 . RESEARCH & WRITING **9**

The project/term paper, selecting a topic, using a library, compiling a working bibilography, taking notes, plagiarism, outlining, writing drafts, guides to writing.

2 . MECHANICS OF WRITING **9**

Spelling, punctuation, numbers, titles and quotations.

3 . FORMAT OF A TERM/PROJECT REPORT **9**

Typing, paper, margins, spacing, heading and title of paper, page numbers, tables and illustrations, corrections and insertions, binding.

4 . PREPARATION OF CITATIONS **9**

General guidelines, placement, arrangement, citing books, citing articles in periodicals, documenting sources, what is a document, parenthetical documentation, information required in parenthetical documetation, readability, sample references.

5 . ABBREVIATIONS AND REFERENCES **9**

Introduction, time, common scholarly abbreviations and references words, publishers names, symbols and abbreviations used in proof-reading and correction, literary and scientific indexing.

Total No of periods: 45

IB034 Technical Writing and Communication **3** **0** **0** **100**

Text Book:

1. Gibaldi W.S. " Achtert Handbook for Writers of Research Papers ", Wiley Eastern Reprint, 1987.

Reference:

1. " Chicago Manual of Style 13 Edition ", Chicaco, University of Chicaco Press.