ECET – 2014

Distribution of Marks

Objective type of Questions (Multiple Choice) only

1. For Engineering

S. No :	Subject	Weightage
1.	Mathematics	50 Marks
2.	Physics	25 Marks
3.	Chemistry	25 Marks
4.	Engineering Subjects (Separate for each Branch)	100 Marks
	Total	**200 Marks**

2. For Pharmacy

S. No :	Subject	Weightage
1.	Pharmaceutics	50 Marks
2.	Pharmaceutical Chemistry	50 Marks
3.	Pharmacognosy	50 Marks
4.	Pharmacology	50 Marks
	Total	**200 Marks**

3. For B.Sc – Mathematics

S. No :	Subject	Weightage
1.	Mathematics	100 Marks
2.	Analytical Ability	50 Marks
3.	Communicative English	50 Marks
	Total	**200 Marks**

ECET – 2014
List of Syllabus

S. No :	Departments
1.	Mathematics
2.	Physics
3.	Chemistry
4.	Electrical and Electronics Engineering
5.	Mechanical Engineering
6.	Civil Engineering
7.	Electronics and Communication Engineering
8.	Computer Science and Engineering
9.	Metallurgical Engineering
10	Chemical Engineering
11.	Ceramic Engineering
12.	Mining Engineering
13.	Electronics and Instrumentation Engineering
14.	Bio-Technology
15.	Pharmaceutics
16.	Pharmaceutical Chemistry
17.	Pharmacognosy
18.	Pharmacology
19.	B.Sc. (Maths)
20.	Analytical Ability
21.	English

SYLLABUS

FOR DIPLOMA HOLDERS

1. MATHEMATICS (Common Syllabus)

Unit-I Matrices:

Matrices of 3rd order: Types of matrices-Algebra of matrices-Transpose of a matrix-Symmetric, skew symmetric matrices-Minor, cofactor of an element-Determinant of a square matrix-Properties-Laplace's expansion-singular and non singular matrices-Adjoint and multiplicative inverse of a square matrix-System of linear equations in 3 variables-Solutions by Crammer's rule, Matrix inversion method,-Gauss-Jordan methods**.**

Partial Fractions: Resolving a given rational function into partial fractions.

Unit –II:

Trigonometry: Properties of Trigonometric functions – Ratios of Compound angles, multiple angles, sub multiple angles – Transformations of Products into sum or difference and vice versa – Simple trigonometric equations – Properties of triangles – Inverse Trigonometric functions.

Complex Numbers: Properties of Modulus, amplitude and conjugate of complex numbers, arithmetic operations on complex number—Modulus-Amplitude form (Polar form)-Euler form (exponential form)-Properties- De Movire's Theorem and its applications.

Unit – III : Analytical Geometry

Circles-Equation of circle given center and radius, given ends of diameter-General equation-finding center and radius. Standard forms of equations of Parabola, Ellipse and Hyperbola – simple properties.

Unit – IV : Differentiation and its Applications

Functions and limits – Standard limits – Differentiation from the First Principles – Differentiation of sum, product, quotient of functions, function of function, trigonometric, inverse trigonometric, exponential, logarithmic, Hyperbolic functions, implicit, explicit and parametric functions – Derivative of a function with respect to another function-Second order derivatives –Geometrical applications of the derivative (angle between curves, tangent and normal) – Increasing and decreasing functions – Maxima and Minima (single variable functions) using second order derivative only – Derivative as rate measure -Errors and approximations - Partial Differentiation – Partial derivatives up to second order – Euler's theorem.

Unit – V : Integration and Its Applications

Indefinite Integral – Standard forms – Integration by decomposition of the integrand of trigonometric, algebraic, exponential, logarithmic and Hyperbolic functions – Integration by substitution – Integration of reducible and irreducible quadratic factors – Integration by parts – Definite Integrals and properties, Definite Integral as the limit of a sum – Application of Integration to find areas under plane curves and volumes of Solids of revolution – Mean and RMS value.

Unit – VI: Differential Equations

Definition of a differential equation-order and degree of a differential equation- formation of differential equations-solution of differential equation of the type first order, first degree, variable-separable, homogeneous equations, exact, linear differential equation of the form $dy/dx + Py = Q$, Bernoulli's equation, nth order linear differential equation with constant coefficients both homogeneous and non homogeneous and finding the Particular Integrals for the functions e^{ax}, x^m, ,*Sin ax, Cos ax.*

2. PHYSICS (Common Syllabus)

Unit-1: Units and dimensions: Physical quantity-fundamental and derived physical quantities-units-fundamental and derived units-SI units-multiples and sub-multiples in SI units-advantages of SI units-dimensions and dimensional formulae-dimensionless quantities-applications and limitations of dimensional analysis-problems.

Unit-2: Elements of vectors:

Scalar and vector quantities-examples–graphical representation of a vector-types of vectors-addition and subtraction of vectors-triangle law-parallelogram law and its cases-polygon law-resolution of a vector-unit vectors (i, j, k)-dot product and cross product of two vectors-characteristics of dot and cross products-examples-problems.

Unit-3: Kinematics and Friction

Equations of motion-acceleration due to gravity-equations of motion under gravity-expressions for maximum height, time of ascent, time of descent, time of flight, velocity on reaching the point of projection in vertical motion--motion of a body projected from the top of a tower-projectile motion-examples-horizontal and oblique projections-expressions for maximum height, time of ascent, time of flight, horizontal range, magnitude and direction of resultant velocity in oblique and horizontal projections-problems.

Friction- causes and types of friction-normal reaction-laws of friction-coefficients of friction-angle of friction-methods of reducing friction-advantages and disadvantages of friction-motion of a body over a rough horizontal surface,a smooth inclined plane and a rough inclined plane–problems.

Unit-4: Work, Power and Energy

Work, power and energy-definitions and units-potential and kinetic energies-examples and expressions-work-energy theorem-law of conservation of energy-problems-renewable and non-renewable sources of energy (solar, wind, biogas, tidal, nuclear energies etc)

Unit-5: Simple harmonic motion and Sound

Definition-conditions of SHM-examples of SHM-expressions for displacement, velocity, acceleration, time period, frequency and phase of SHM-time period of a simple pendulum-seconds pendulum-problems. Sound-musical sound and noise-noise pollution-Effects and methods of control of Noise Pollution-Beats and echoe-problems-Doppler effect – Explanation, cases and Applications Acoustics of buildings-Reverberation-Sabines' formula-characteristics of a good building-problems.

Unit:6: Heat and Thermodynamics

Expansion of gases-Boyle's law-Absolute scale of temperature-charle's laws-Ideal gas equation-Universal gas constant and its value-SI Units-problems-external work done by a gas-isothermal process-adiabatic process-first law of thermodynamics and its applications to isothermal process and adiabatic process-two specific heats of a gas-relation between Cp and Cv-problems-second law of thermodynamics and its applications.

Unit:7 Modern Physics

Photoelectric effect – explanation and its laws-applications of photoelectric effect (photocell) – critical angle and total internal reflection – optical fibers - principle, working , types and applications-concept of super conductivity – its properties and applications.

3. CHEMISTRY

1. Atomic Structure: Introduction-Fundamental particles – Bohr's theory – Quantum numbers — Aufbau principle – Hund's rule – Pauli's exclusion principle- Electronic configurations of elements up to atomic number 20, shapes of s,p,d orbitals.

2. Chemical Bonding: Introduction – types of chemical bonds – Ionic bond taking example of NaCl and MgO –characteristics of ionic compounds and covalent bond taking example H_2, O_2 ,N_2, HCl characteristics of covalent compounds.

3. Solutions

Introduction solution classification of solutions, solute, solvent, concentration, mole concept– Molarity, –Normality, equivalent weight using acids, bases and salts, numerical problems on Molarity and Normality.

4. Acids and Bases

Introduction – theories of acids and bases – Arrhinus, Bronsted –Lowry theory – Lewis acid base theory – Ionic product of water - P^H and related numerical problems – buffers solutions – Applications.

5. Electrochemistry

Conductors, insulators, electrolytes - Arrhenius theory of electrolytic dissociation – electrolysis – Faraday's laws of
electrolysis- numerical problems – Galvanic cell – standard electrode potential – electro chemical series –emf and
numerical problems on emf of a cell.

6. Water Technology

Introduction –soft and hard water – causes of hardness – types of hardness –disadvantages of hard water – degree of
Hardness, units and its relations– softening methods – permutit process – ion exchange process – qualities of drinking
water – municipal treatment of water for drinking purpose.

7. Corrosion

Introduction - factors influencing corrosion - electrochemical theory of corrosion- composition cell, stress cell and
concentration cells– rusting of iron and its mechanism – prevention of corrosion by a) coating methods, b) cathodic
protection (sacrificial and impressive voltage methods).

8. Polymers

Introduction – polymerisation – types of polymerisation – addition , condensation and co-polymerisation with
examples – plastics – types of plastics – advantages of plastics over traditional materials – Disadvantages of using
plastics ,thermo plastics and thermo stetting plastics– differences between thermo plastics and thermo stetting plastics-
preparation and uses of the following plastics : 1. Polythene 2. PVC 3. Teflon 4. Polystyrene 5.Urea formaldehyde –
Rubber – natural rubber – processing from latex –Vulcanization – Elastomers – Buna-s, Neoprene rubber and their
uses.

9. Fuels

Definition and classification of fuels based on physical state and occurrence – characteristics of good fuel - Extraction and Refining of petroleum - composition and uses of gaseous fuels. A) water gas b) producer gas c) natural gas d) coal gas e) bio gas f) acetylene

10. Environmental chemistry

Introduction – environment –understand the terms lithosphere, hydrosphere, atmosphere bio sphere, biotic component, energy component pollutant, receptor, sink, particulate, DO, BOD, Threshold limit value, COD- Air pollution - causes-Effects – acid rain, green house effect –ozone depletion – control of Air pollution – Water pollution – causes – effects – control measures.

1. CIVIL ENGINEERING

STRENGTH OF MATERIALS

UNIT:1 Simple stresses and strains-curves for ductile materials-Mechanical properties of materials-Hooke's law-lateral strain-Poisson's ratio-Elastic constants and the relation between them-Composite sections-Resilience-Strain energy-Gradual and sudden loading-Shear force and Bending Moment Diagrams for cantilever, Simply supported, fixed, continuous and overhanging beams subjected to Point loads and UDL

UNIT:2 Theory of simple bending-assumptions-bending equation-bending stresses-Section Modulus-Shear stress distribution across various sections like rectangular, circular and I-sections-Torsion-solid and hollow circular shafts.

THEORY OF STRUCTURES:

UNIT:3 Deflection of cantilevers and simply supported beams-Double Integration and Macaulay's methods-Mohr's theorems for slope and deflections-calculation for propped cantilevers subjected to simple loading-Analysis of Fixed and Continuous beams of uniform section for simple loading without sinking of supports. Columns and struts-types-slenderness ratio- Euler's and Rankine's formulae for axial loading. Determination of forces in members of statically determinate, plane and pin-jointed trusses for dead loads only. Dams and retaining walls-conditions for stability-middle third rule-Rankine's formula for active earth pressure.

REINFORCED CONCRETE STRUCTURES:

UNIT:4 Grades of concrete, characteristic strength, Modulus of Elasticity-I.S. 456 -2000-Philosophy of Limit state design. Limit state of Strength and Serviceability, partial safety factor-design strength of materials and design loads-assumptions.

Analysis and Limit state design of rectangular beams-Singly, Doubly reinforced and T-beams. Shear in RCC beams, lintels and sunshades-Development length.

Slabs-analysis and limit state design of one-way and two-way slabs as per IS.456-2000. Torsion reinforcement. Design of continuous slabs and beams-Deflection check for Slabs and beams. Detailing of reinforcement in Singly reinforced and doubly reinforced simply supported beams of rectangular sections and lintels, one way and two way slabs.

UNIT:5 Columns: Codal provisions of I.S 456-2000-short and long columns-different shapes-design of short columns by limit state method-long columns- concept, effective length for different end conditions. Footings-Isolated column footings-one way shear and two way shear. Stairs-types, loads on stairs.

Working stress method of design: Basic principles, neutral axis, lever arm-Design and analysis of Singly reinforced simply supported rectangular beams. Comparison of Limit state and Working stress methods.

SURVEYING:

UNIT:6 Chain surveying- purpose and principle- errors and corrections- different operations in chain surveying- obstacles – methods of calculation of area. Compass Surveying- purpose and principle- bearings- traversing using prismatic compass- local attraction- errors. Levelling- definitions- component parts- errors- classification of levelling- contouring-characteristics and methods. Theodolite- principles and component parts- fundamental lines and relationship among them- adjustments of theodolite- measurement of horizontal and vertical angles- errors- traverse computations- bowditch and transit rule. Tacheometry-principle- stadia tacheometry- tangential tacheometry, Principle and uses of E.D.M, Electronic Theodolite, Total Station, Global positioning System – Importance, G.I.S – Use and applications in Civil Engineering

HYDRAULICS.

UNIT:7 Fluid properties-specific weight –mass density-specific gravity-surface tension-capillarity-viscosity. Atmospheric pressure, gauge pressure and absolute pressure. Fluid pressure on plane surfaces-Centre of pressure, measurement of fluid pressure using piezometer and manometers. Types of flows-uniform, non uniform, steady, un steady, laminar and turbulent flows. Energies of liquid in motion-continuity equation. Bernoulli's theorem-Pitot tube-Venturimeter. Flow thorough small and large orifices, free orifices,

submerged orifices, co-efficients of orifices-Cc, Cv and Cd. Flow through internal, external, convergent and divergent mouthpieces. Types of Notches-rectangular and triangular, flow over notches. Types of Weirs-sharp crested and broad crested-mathematical formulae for discharge-Francis and Bazin.

UNIT:8 Flow through pipes-major and minor losses-Chezy's and Darcy's formulae for loss of head due to friction-HGL & TEL- flow through siphon pipes. Reynold's number for laminar and turbulent flows. Flow through open channels-rectangular and trapezoidal-chezy's formula for discharge-Kutter's and Manning's equation for Chezy's constants-Most economical sections. Centrifugal pumps without problems. Classification of Turbines-Kaplan, Francis and Pelton wheel without problems-use of Draft tube. Hydro-electrical installations-components and uses.

IRRIGATION ENGINEERING:

UNIT:9 Necessity of Irrigations - Perinnial and inundation Irrigation , Flow and Lift Irrigation, Principal crops-kharif and rabi seasons-Duty, delta and base period. Methods of Irrigation-check flooding, basin flooding, contour bunding, furrow, sprinkler and drip Irrigations. Hydrology – Rainfall , types of Rain gauges, types of catchments-rainfall and runoff. Measurement of velocity of flow in streams-Ryve's and Dicken's formulae for computing maximum flood discharge. Classifications of Head works-component parts of diversion head works. Weirs and Barrages. Perculation and uplift pressures.Types of Reservoirs-dead storage, live storage and surcharge storage.

UNIT: 10 Storage Head works-different types of dams-rigid and non rigid dams- gravity dams-low and high dams. Elementary profile of a dam. Failures of gravity dams-drainage galleries. Ogee and siphon spillways. Earth dams— types, failures and precautions. Phreatic lines and drainage arrangements in earthen dams. Distribution works-classifications and alignment of canals-typical cross section of a canal-berm and balanced depth of cutting- canal lining. Lacey's silt theory. Cross drainage works –types and functions.

2. ELECTRICAL & ELECTRONICS ENGINEERING

UNIT I:- BASIC ELECTRICAL ENGINEERING

Ohms and Kirchhoff's Laws, star/delta transformation, Network theorems, Power and Energy, Heating effects of Electric current, Magnetic effects, Electromagnetic Induction, Electrostatics, Batteries, Types of Electrical Engineering Materials – Conducting, Semi-conducting, Magnetic, Insulating, Di-electric – Properties and Uses.

UNIT II:- D.C. MACHINES, BATTERIES & MEASURING INSTRUMENTS:

D.C. Generators: Construction, Operation, types, EMF Equation, Windings, Characteristics, Efficiency and Parallel operation.

DC Motors: Principle of operation, Back EMF, Torque Equation, Types, armature reaction. Characteristics, Starters, Speed Control, Losses, Efficiency and Testing, Batteries.

Measuring Instruments: Classification, Principle of Operation of moving Coil, Moving Iron, Dynamometer type, Induction type meters, Instrument Transformers, Induction type Energy meter, M.D. Indicator, Trivector Meter, PF meter, Frequency meter, Measurement of Resistance, Transducers and Sensors – Types, Thermistor, Thermocouple, Pressure Transducers and Strain gauges.

UNIT III:- A.C. CIRCUITS AND TRANSFORMERS:

A.C. Circuits: Fundamentals, Series and parallel R-L-C Circuits, Resonant circuits, Polyphase Circuits, Measurement of power by 2 Wattmeters.

Transformer:_Single-phase Transformer, Construction, Operation, Equivalent circuit, regulation, efficiency, Testing and Parallel operation, Accessories of Transformers and Cooling. Three-phase Transformers, Auto-Transformers.

UNIT IV:- A.C. MACHINES

Alternators: Construction, Operation, EMF equation, regulation, testing and parallel operation.

Synchronous Motors: Operation and performance, effects of field excitation, 'V'-Curve and inverted 'V'- Curve, methods of Starting and uses.

Three-Phase induction Motors: Construction, Principle of Operation, Torque Equation, Slip-torque characteristics, losses, efficiency, speed control, starters, double-cage motor.

Single-phase Motors:

Induction Motor: Types, Principle of operation, applications.

Commutator motors: Types, Principle of operation and applications.

UNIT V:-POWER SYSTEM GENERATION & PROTECTION

Generating Stations: Working, Components, Comparison of Thermal, Hydel, Nuclear and Gas Power stations. Pollution control, Combined Working, Power Stations auxiliaries, Characteristic Curves and Important Terms, types of tariffs, power factor correction and economy.

Power Systems Protection: Circuit Breakers – Types, Principles of operation and uses, Current Limiting reactors, Relays – Classification, Principle of Operation of Induction type over current relay, Directional and Non directional relays, differential relays and distance relays, Protection of alternators, Transformers, Bus-bars, Transmission lines, Lightening arrestors, neutral grounding.

UNIT VI:- TRANSMISSION AND DISTRIBUTION

Transmission and distribution: Types of supply systems, Transmission line parameters, inductance and capacitance, performance of short and medium lines, regulation, Ferranti effect, Corona, Basic concepts of HVDC Transmission, advantages and disadvantages of HVDC Transmission.

Components of lines, supports, conductor spacing, ground clearance and sag, insulators, voltage distribution across the string, string efficiency, methods of improving string efficiency. Earthing and layout of sub-stations.

Cables – Classification, insulation resistance, specifications. Distribution – Radial and ring distributors, variation of load voltage.

UNIT VII: - ELECTRIC TRACTION

Electric Traction: Systems of Train Electrification, Speed-time Curves for different services, Schedule speed, Tractive Effort, Specific Energy Consumption, Traction system auxiliaries, Traction motor.

UNIT VIII:-

ELECTRICAL ESTIMATION

Electric Wiring: Tools, Wires, Types of wiring, Accessories, Lamp Circuits, Estimating and costing of domestic, industrial, power, irrigation pump sets, over head lines and 11KV Substations, Rural electrification, departmental tests, earthing, maintenance of electrical machines.

UNIT IX: BASIC ELECTRONICS AND DIGITAL ELECTRONICS

Semi-Conductor devices: N type & P type,, Zener diode, PNP and NPN Transistors, Transistor configurations, characteristics, half and full wave rectifiers, Filters, Zener diode, regulation.

Special devices : UJT, FET, LED, SCR, Opto Coupler, Photo diode, Photo Transistor, CRO and Timers.

Amplifiers: Types, Principles of operation, Characteristics.

Oscillators: Types, operation and application of each.

Digital Electronics: Different numbering systems, inter Conversions Boolean Algebra, Logic families, performance of AND, OR, NOT, NOR, NAND, EX-OR gates, combinational Logic Circuits, sequential logic circuits, Resistors and Memories, A/D and D/A converters.

UNIT X:- POWER ELECTRONICS AND MICRO CONTROLLER

Power Electronic Devices: Construction and working of SCR, GTOSCR, DIAC, TRIAC, Volt-ampere characteristics, Triggering of SCR using UJT, Protection.

Converters, AC regulators, Choppers, Inverters and Cycloconverters:

Types of Converters, working of AC regulators and Choppers. Types of inverters, Principles of working of Cyclo converters.

Speed Control of DC/AC motors and application of power devices:

Speed control of D.C. Shunt Motors by using converters and choppers, Speed control of Induction motor by using V/F Control. Switched mode power supplies (SMPS), UPS, offline and online UPS.

Micro Controllers: Architecture of 8051, instruction set of 8051, programming concepts, peripheral ICS – Function, features.

3. MECHANICAL ENGINEERING

Unit I: Workshop Technology

Basis Workshop tools and Operations (carpentry, fitting and sheet metal) Metrology – liner, angular and surface measurement – comparators.

Working and operations of lathe, Drilling, Shaper, slotter, Planner and milling machines – Capstan and turret lathes – copying lathes – surface finishing operations – Honing, lapping, super finishing, electro plating, metal spraying.

Basic components of NC, CNC, and DNC machines – FMS and robotics, CNC part programming-Manual and Computer assisted

Unit II: Welding, Forging, Foundry and Conventions in drawing

Equipment used in arc and gas welding. Modern welding methods – Submerged arc, atomic, hydrogen, CO_2, and ultrasonic welding. Forging processes and tools - Cold and hot working processes. Pattern types – types of molding sand and their properties - Defects in casting and welding. Conventional representations in machine drawing – production drawing – limits, fits & Tolerances – surface finish – Specifications of standard components like Bolts, Nuts, Bearings etc.

Unit III: Engineering Materials, and Solid Mechanics

Mechanical properties of materials – Destructive and Non destructive testing of materials, Production of Iron and Steel – Iron Carbon equilibrium Diagram - Heat treatment processes – Plain Carbon and alloy steels – Ferrous and Non ferrous metals and alloys – Powder metallurgy .

Resolution of Forces, Simple Machines, Simple stresses and strains – Shear force and bending moment diagrams – Strain energy – Deflection of beams.

Unit IV: Design of Machine Elements

Belt, rope and chain drives – Velocity ratio, Belt tensions and centrifugal tension – Effect of belt thickness – Slip, lengths of open and cross belting – Power transmitted by belt, Simple, Compound, and epicyclic gear trains – Roller and Silent chains – Design of – Bolts, Nuts and Screws - Shafts, Keys, Couplings – Thin cylindrical Shells – Springs, cams, Flywheels and Governors

Unit V: Thermodynamics

Basic thermodynamics and Laws of Perfect gases, Thermodynamic processes, Air standard Cycles, fuels and combustion, I.C Engines - two and four stroke engines – Petrol and Diesel engines, Indicated and brake powers, Indicated and brake thermal efficiencies, Air Compressors, Gas turbines and Jet propulsion.

Unit VI: Hydraulic Machines and Pneumatics

Properties of Fluids , Flow through pipes, Impact of Jets, Hydraulic turbines, Governing, Working principles and operation of reciprocating and centrifugal pumps, Hydraulic and pneumatic Circuit devices, air cylinders and Hydro Pneumatic Systems.

Unit VII: Steam Boilers, Nozzlers and Turbines

Properties of Steam, Working, Performance of Boilers, Steam nozzles, Condition for maximum discharge – steam turbines – classification, Velocity diagrams for single stage impulse turbine and Reaction turbine.

Unit VIII: Refrigeration

Methods of refrigeration, Cycles and Analysis - Air, Vapor Compression and vapor absorption refrigeration, refrigeration equipment

Unit IX: Industrial Management and Engineering

Principles and functions of management, organization structures, Production and materials management, financial management, entrepreneurial development, Marketing and sales, Principles of ISO 9000, Work study, Inspection and Statistical Quality Control, Estimation and Costing.

Unit X: Automobile Engineering

Automobile Chassis construction, Function of transmission system, Gear boxes, single and multiplate clutches, Function and construction of propeller shaft, Universal Joint, Differential, semi and full floating rear axle, Front and Stub axles, wheel alignment and balancing, steering mechanisms.

Braking system - weight transfer during braking, skidding, Hydraulic braking and air pressure braking systems.

7. ELECTRONICS AND COMMUNICATION ENGINEERING

1. ELECTRONIC DEVICES AND CIRCUITS: Semiconductor diodes – varactor diode – zener diode – Clippers and clampers-Transistors– FETs – UJT (characteristics only) – Power supplies – Rectifiers and Filters – HW, FW and Bridge type – RC , LC and CLC filters – Series and Shunt regulators, IC regulators – Transistor amplifiers – CE,CC and CB configurations – Biasing techniques-RC coupled – Transformer coupled amplifiers Differential amplifiers – Feedback, Power and Tuned amplifiers, Darlington pair amplifier – Operational amplifiers – characteristics and applications – RC , LC and Crystal oscillators – Astable , Bistable and Monostable Multivibrators using Transistors and 555 timers- Schmitt Trigger – Sweep circuits – Miller and Bootstrap circuits, VCO,PLL- Fabrication of ICs.

2. CIRCUIT THEORY: Mesh current and Node voltage analysis – Crammer's Rule – Network theorems – Thevenin's, Norton's, Maximum Power transfer, Superposition and Reciprocity theorems– Series and Parallel Resonance – Q- factor – Selectivity – Bandwidth-Coupled circuits, Transient analysis-RC and RL, Linear wave shaping circuits. Transmission Lines – Characteristic Impedance –Reflection Coefficient – SWR – Transmission Line losses and Impedance matching.

3. ELECTRONIC MEASURING INSTRUMENTS:

Analog Instruments – Extension of range of Ammeter, Voltmeter and Ohmmeter – FET voltmeter – Differential voltmeter- Bridges-Wheatstone, Maxwell , schering – Digital instruments – Ramp –Dual Slope integration – successive approximation – digital frequency meter-digital LCR meter- CRO – CRT – time base generator – deflection sensitivity – triggered sweep circuits – CRO applications, AF Oscillator – RF Signal generator – AF and RF Power meters – Q meter – Distortion Factor Meter – Digital IC tester, logic analyser, spectrum analyser-XY plotters

4. INDUSTRIAL AND POWER ELECTRONICS: Thyristor family – SCR ,TRIAC, Power BJT –IGBT (characteristics, working principle and applications) – Converters – Single phase HW , FW fully controlled - Choppers – modes of operation – Inverters and Cycloconverters – Series and Parallel Inverters– PWM inverters,– Speed control of AC / DC motors using converters and choppers. – Off Line and On Line UPS – Opto electronic devices – LDR, Photo diode and transistor and Photo voltaic cell (characteristics and applications) – Transducers – LVDT – Strain Gauge, Thermocouple - Ultrasonics - Pulse echo flaw detector.

5. COMMUNICATION SYSTEMS: Analog – Need for modulation – Types of modulation – AM , FM , PM – Modulation Index – Bandwidth – Power requirements – Transmitters – Low level and High level types – Receivers – Super heterodyne – AM and FM receivers – characteristics – Sensitivity , Selectivity , Fidelity – IMRR and choice of IF – Wave Propagation – Ground , Sky and Space waves – Properties. Digital – Pulse modulation – PCM , Delta modulation – Data codes – Synchronous and Asynchronous transmission – error detection and correction - digital modulation – ASK ,FSK, PSK and QAM – generation and detection – Multiplexing – TDM , FDM – Multiple Access – TDMA, FDMA –PSTN, ISDN, EPABX, FAX– Internet Telephony

6. ADVANCED COMMUNICATION SYSTEMS: Antennas– radiation resistance – beam width – polarization – directivity – efficiency – bandwidth – gain – front to back ratio – folded dipole – arrays – broadside – end fire – Yagi , Log periodic , Turnstile antennas – Parabolic reflectors – beam width, gain and applications. Wave Guides – Rectangular – Dominant mode – Phase and Group velocity – Cut off wavelength - working principle and applications of Magnetron , Klystron ,TWT – Radar – range equation – Pulsed radars – indicators – duplexers – CW radars and MTI radars–ILS – Satellite communication – UP link and DOWN link frequencies – types of satellites – satellite on board – earth station systems – satellite applications– GPS – Fiber Optic communication – types of fibers – couplers, splices, connectors, switches , optical emitters and detectors – optical repeaters and amplifiers – Wave length Division multiplexing –DWDM – Mobile Communication – cellular concept – AMPS , GSM , CDMA, DECT and EDGE systems.

7. DIGITAL ELECTRONICS: Number systems – Logic gates – Boolean algebra – Adders and Subtractors, Multiplexers, Demultiplexers-Encoders-decoders, Comparators – Flip-flops – Registers and Counters – Memories – RAM, ROM, Flash ROM, NVROM, Cache Memory, Virtual Memory, Associative Memory – D/A converters – binary weighted – R-2R Ladder, A /D Converter - Counter and Successive approximation types.

8. MICROCONTROLLERS AND MICROPROCESSORS: 8051 Architecture – Instruction Set – subroutines – use of input and output machine related statements – time delay programme – assembler directives - peripheral ICs – 8251, 8255, and 8257– 8086 Architecture – Instruction Set – Features of 80286, 80386,80486 and Pentium.

9. AUDIO VIDEO SYSTEMS: Recording and Reproduction of Sound using Magnetic and Optical methods – Television Picture elements – scanning and synchronization – blanking and interlacing – composite video signal , flicker, CCIR standards – camera tubes – Image Orthicon – Silicon Diode array – TV receivers – Tuner, IF , Sync separator , deflection circuits , EHT and sound circuits – Color TV – Additive and subtractive mixing – Color Picture tubes – degaussing – types of color TV systems – NTSC , PAL and SECAM – PAL system processing – DTH system– Cable TV– HDTV– Basics of Remote control

10. DATA COMMUNICATIONS AND COMPUTER NETWORKS: Transmission Media – twisted pair – UTP –STP –Coaxial cable – Optical fibre – comparison – Shannon Capacity theorem – Network Topologies – BUS, STAR , RING – switching – Packet and Circuit switching – OSI 7-layer model and functions – CSMA and token ring – properties and operations – Wireless LAN – Blue tooth technology – WAN architecture – Packet transmission – ARPA Net – ISP and ISDN architectures – WAN Protocols – TCP / IP features and comparison –Ports and Sockets – Domain Name System – Email – File transfer protocol – Proxy server and Web server architecture – Web Browser Architecture.

8. COMPUTER SCIENCE AND ENGINEERING

1. Digital Electronics: Logic Families: TTL, ECL, MOS – Logic gates AND,OR,NOT,NOR,NAND and XOR – Boolean Expressions – K-map –Combinational Circuits – Flip-flops – registers – Counters – decoders, multiplexers and semiconductor memories.

2. Microprocessors: 8086 microprocessor – architecture, segmentation concepts – register organization – addressing modes – instruction set – preliminary features of 80286, 80386 and 80486

3. Computer Organization: Functional blocks of CPU – Fixed point, floating point number representations –instructions – addressing modes – stored program concept – instruction execution – memory hierarchy – virtual memory, associative memory – cache memory – I/O organization – methods of data transfer – programmed I/O, DMA, Interrupts – IOP

4. C and Data Structures: Data types, storage classes, operators and expressions – control statements – functions, parameter passing – arrays and pointers, structures, unions – type definitions – pre processor statements – files – Data Structures – Linked Lists – queues and stacks – trees – sorting : bubble, selection , quick and merge sorts -Searching : linear and binary search techniques

5. Computer Networks: OSI reference model , TCP/IP reference model –Network topologies : Bus, Ring, Star, Mesh, Hybrid – LAN components – Coaxial, twisted pair, optical fiber cables and connectors – repeaters, hubs, switches, NIC – Ethernet, token bus, token ring, inter network packet exchange/sequenced packet exchange – HTTP, FTP, SMTP, Telnet – TCP/IP addressing scheme – IP address classes - sub netting

6. Operating Systems: Operating system concepts, functions, types, system calls – process management – CPU scheduling algorithms – deadlocks – memory management – overlays, paging, segmentation, virtual memory, page replacement algorithms – disk scheduling – free space management – allocation methods – disk scheduling algorithms

7. RDBMS: Need of database systems, data independence, Data models, E-R model – structure of relational database – normal Forms : 1st, 2nd, 3rd and BCNF – SQL – data types, operators, DDL and DML commands – views, sequences, synonyms, indexes and clusters – PL/SQL – data types, control structures, cursor management, exceptions, functions, procedures and packages

8. Object Oriented Programming Through C++: Concept of OOPs – classes and objects – Constructors and destructors – arrays, pointers, references, strings – function overloading and operator overloading – inheritance – virtual functions – friend functions –this pointer – i/o manipulators – file and i/o functions

9. Java Programming: Java – data types, variables, operators, arrays – Classes and objects – methods – constructors – overloading –inheritance - Visibility mode – packages – interfaces – multithreading – exception handling – applets

10. Internet Programming : Internet fundamentals – HTML, tags, attributes, formatting text – VB script –data types, operators – control structures – procedures and functions – ASP objects and components – use of ASP with database.

9. CHEMICAL ENGINEERING

(Includes leather, Sugar, Textile Technology, CHPC, CHPP, and CHOT)

1. Material technology: Mechanical properties of metals and Testing of materials – thermal equilibrium diagram- Production of Iron-plain carbon steels, alloy steels – Non-ferrons metals & their alloys- Alumininum,coper,nickel,lead,tin,zinc-Miscellaneous materials – Glass, carbon, graphite, rubber, elastomers, fiberglass and FRP etc.. – Corrosion- causes, types, methods of prevention.

2. Chemical process principles: Determination of molarity, molality & normality, analysis of solids , liquids and gases on dry and wet basis - Daltons law , ideal gas equation of state , vapor pressure boiling point and freezing point , elevation of boiling point and depression of freezing point-uses, Bypassing ,Recycling & purge streams – uses , limiting component , excess reactant , percentage conversion & yield and degree of completion - Material balances with and without chemical reactions-Law of conservation of energy , heat of reaction , heat of formation , and heat of combustion – related problems , gross and net calorific values , theoretical air and excess air calculations – Proximate and ultimate analysis.

3. Organic Chemical Technology: Coal chemicals, coking of coal, coal tar distillation, petroleum refining-atmospheric distillation and vacuum distillation , fluid catalytic cracking , catalytic reforming , petrochemicals from methane and ethylene - Pulp and paper industry, Kraft process - Oils , fats and soaps -sugar & fermentation – synthetic fibers - rubber industries.

4. Inorganic Chemical Technology: Water-sources, impurities-treatment-dissolved solids-ion exchange process and Reverse Osmosis (RO) process - Manufacture of chemicals like, soda ash, ammonia, Urea, nitric acid, sulphuric acid, phosphoric acid, Super Phosphate and industrial Gases (O_2,N_2, H_2 ,CO_2 and acetylene) - Paints, pigments and varnishes, graphite and silicon carbide and cement.

5. Fluid mechanics: Flow of incompressible fluids, Newtonian and non-Newtonian fluids, viscosity, Bernoulli's theorem, friction losses, flow meters, different types of pumps for transportation of fluids, Flow past immersed bodies, fluidization - packed bed and fluidized bed.

6. Heat transfer: Conduction – mechanisms of heat flow – Fourier's law, thermal conductivity, steady state conduction- compound resistances in series, heat flow through a cylinder – related problems. Convection – heat flow in fluids- rate of heat transfer, average temperature of fluid stream – Overall heat transfer coefficient – LMTD – Fouling factors – Heat transfer to fluids with and without phase change. Radiation – fundamentals, emission of radiation, black body radiation, laws of black body radiation – radiation between surfaces.- Heat Exchange Equipment – types of heat exchange equipment, counter current and parallel current flows.- Evaporation – liquid characteristics and important properties, types of evaporators, condensers, ejectors- evaporator economy- single and multiple effect –related problems..

7. Mechanical unit operations: Size reduction methods, laws of size reduction- crushers and grinders. different types of equipments for mixing dry powders, differential and cumulative screen analysis, screen effectiveness, average particle size, storage of solids, conveyers, froth floatation, electrostatic precipitator ,scrubber, cyclone separators, filtration, sedimentation.

8. Thermodynamics and Reaction Engineering: 1st law of Thermodynamics, PVT relationships for gases, 2nd law of Thermodynamics, refrigeration and liquefaction, determination of equilibrium constant and conversion, Temperature effect on reactions – Arhenius equation. Basic equations & working of batch, tubular and stirred tank reactors, catalysis.

9. Mass Transfer: Principles of diffusion, inter phase mass transfer, distillation, absorption and adsorption, humidification, membrane separation, extraction and leaching, drying, crystallization.

10. Instrumentation & process control: Static and dynamic characteristics of an instrument-step input, linear input, sinusoidal inputs, measurement of temperature, pressure, vacuum, liquid levels and composition. process instrumentation & Instrumentation diagrams - Process control, different types of controllers, concepts of DCS (Distributive control systerm).

11. Environmental Studies and Pollution Control Engineering: Scope and importance of environmental studies,Effect of human being on environment and vice- versa - Water pollution, types, classification, treatment methods - Air pollution, types, classification, analysis, control methods - Solid waste management, sources, classification, disposal - Pollution control in sugar, fertilizer & petroleum industries - Legal aspects.

12. Energy Technology & Plant Operation: Classification of energy sources-Solid, Liquid, and Gaseous fuels – Combustion principles, Refractories, Furnaces - Blast Furnace, LD Converter - Nuclear Energy, Solar Energy, Wind Energy and Bio-Energy – Energy Conservation - Industrial Hazards and Prevention -Safety and first Aid

10. METALLURGICAL ENGINEERING

1. ELEMENTARY PRINCIPLES OF METALLURGY: Introduction to metallurgy – ores & ore dressing, Methods of ore sampling – Communition – Screening & Classification - Principles and processes of Pyro, hydro and electrometallurgy –Minerals of commercially important metals.

2. FUELS, REFRACTORIES AND PYROMETRY: Classification of solid, liquid and gaseous fuels – Testing and properties of important fuels-Manufacture and characteristics of Metallurgical Coke - Combustion of fuels – Properties, manufacture and selection of Refractories, Principles and operation of important pyrometers.

3. METALLURGICAL THERMODYNAMICS: Introduction and applications of thermodynamics –First Law of thermodynamics- Thermo chemistry - Second Law of thermodynamics - Ellingham diagrams - Fugacity, activity and equilibrium constant -Phase equilibria – Solutions. Fundamentals of Reaction Kinetics

4. PHYSICAL METALLURGY: Structure of Metals and Alloys – Solidification - Diffusion – Binary thermal equilibrium diagrams-Iron-carbon diagram- important non-ferrous binary alloy systems – Microscopic and macroscopic examination of metals and alloys.

5. HEAT TREATMENT TECHNOLOGY: Heat treatment of plain carbon steels - Annealing, Normalizing, Hardening and tempering of steels – TTT diagrams - Hardenability - Grain size, Quenching media. Alloy steels & Effect of alloying elements on plain carbon steels – Stainless steels, tool steels – Case hardening techniques. Special heat treatment techniques such as Austempering , Martempering, sub-zero treatment - Heat treatment of Non-ferrous metals and alloys – Age hardening - Heat Treatment Furnaces .

6. FERROUS EXTRACTIVE METALLURGY: Iron ores and preparation of iron ores - Blast furnace plant and equipment – blast furnace reactions - irregularities and recent trends - sponge iron & methods of production – Ferroalloys – types and applications. Steel making by Bessemer, LD, Kaldo, Oxygen Lime (LDAC) process, Open hearth and Electric furnaces – New techniques in steel making – Vacuum treatment of liquid steel - Ingot defects - Continuous casting.

7. NON-FERROUS EXTRACTIVE METALLURGY: Extraction of copper – Pyro and hydrometallurgical methods & refining - Aluminum- Extraction, Anode effect, Refining - Zinc and Lead - Pyro and hydrometallurgical extraction and refining. Extraction of Magnesium by Dows and pidgeon processes. Extraction of Titanium by Kroll's process - Refining of Titanium by Van arkell's process-Extraction of Thorium and Zirconium.

8. MATERIAL TESTING: Tension test. Stress- strain relationships, necking phenomenon. Hardness tests-principles and types. Impact testing-Notched bar impact tests. Transition temperature. Fatigue, Stress cycles, S-N diagram, Factors affecting Fatigue. Creep testing - creep curve, Stress - rupture test. Non-destructive testing- Principles, methods and applications of liquid penetrant, Radiography, Ultrasonic Magnetic particle and Eddy current test.

9. MECHANICAL METALLURGY: Plastic deformation of metals – lattice defects – Slip and Twinning - CRSS –Strengthening mechanisms. Strain hardening - Hot and Cold working - Recovery, recrystallisation and grain growth. Metal forming processes-Rolling, Forging, Extrusion & Sheet metal forming processes and defects – Thermo mechanical

treatments – isoforming and ausforming. Powder metallurgy. Methods of powder production, Characterization, Compaction, Sintering and applications of Powder Metallurgy.

10. FOUNDRY TECHNOLOGY: Patterns: Types, materials and pattern allowances, Moulding Sands - properties and Testing, Moulding Processes and equipment: Sand casting, Die casting, Shell moulding, Centrifugal casting, Investment casting and CO_2 process-Cores: Types of Cores and properties, pouring and feeding of castings. Cast irons – types, Melting of Cast irons - Grey, S.G and Malleable iron. Aluminium, Copper and Steel Foundry practices. Defects in Castings. Cleaning & Salvage of Castings.

11. WELDING TECHNOLOGY: Basic concepts of Welding - Principles and processes of various welding techniques such as Oxy-acetylene, Shield Arc welding, Inert gas welding-TIG and MIG - Special welding processes- Plasma, resistance, electro slag, electron beam, thermit and Laser. Soldering and brazing– Weldability, factors affecting weldability – Heat affected Zone, Microstructure – Post weld treatments –Welding defects –Inspection and testing.

11. MINING ENGINEERING

1. ELEMENTS OF MINING:

Definitions of Terms, Mineral based industries, Mining operations, modes of entry, shaft, incline, adit-applicable conditions, Mining Methods used in coal and Non coal mining, Classification of the mineral deposits based on various factors, classification of coal seams based on various factors. Classification of methods of working-U/G Coal, OCM & Metal Mining, , Bore(Drill) holes uses, classification and various tools used in boring(Drilling), feed mechanism, core recovery, deviation of boreholes. Explosives- Characteristics, classification, composition, properties, different explosives used in U/G, OCM, Metal and coal mines, selection of explosives and initiation of explosives, Detonators- types, Blasting practice in Mines- terms, tools, sequence of shot firing, drill patterns types, misfires, blown out shots, sockets, treatment of misfires, accidents due to explosives and shot firing, preventive measures, Mine Gases- types, physical and chemical properties, physiological effects and occurrence. Shaft sinking methods – sinking through normal strata, Special methods of shaft sinking pilling, drop shaft method, cementation, freezing method. Temporary, permanent lining of shafts, Support systems in Mining their applicability and withdrawal of supports.

2. MINING GEOLOGY:

Definition of the term Geology, scope, uses of geology in Mining field, Branches of geology, Age of the earth, origin of the earth-Nebular hypothesis of kant and Laplace, Physical Geology, internal structure of earth, weathering, erosion, denudation, Attrition, Abrasion, Earthquakes, its propagation, intensity, causes and effects of earthquakes. Valcanoes and its classification,. Mineralogy-Physical characteristics of minerals, important mineral families, industrial uses of important minerals; Occurrence and distribution in A.P and India. Petrology - Classification of Rocks and its characteristics, structures and textures. Structural Geology, folds,.faults, joints, unconformities. Geological time scale, major stratigraphical divisions of India, Physio-graphic divisions of India, Economic Geology- Terms, processes of mineralization and important economic minerals formed by these processes. Geological prospecting- objectives, guide lines for location of mineral deposits in fields, methods of prospecting. GIS and Remote sensing concepts.

3. METHODS OF WORKING - COAL:

Methods of working Bord and pillar and long wall - development, opening of districts ,different methods of development systems with machines and continuous miners, depillaring. Longwall mining-Long wall advancing, longwall retreating, applicabilities, merits, demerits, limitations. Special methods of working like inclined slicing, horizontal slicing, blasting gallery, horizon mining. Stowing practice in mines, manual and mechanized. modern trends of open cast coal methods..

4. METHODS OF WORKING METAL:

Definitions: Development of mineral deposits, levels, sublevels, Winzes and Raises etc. Handling waste rock and mineral, Drilling and blasting, arrangement for loading, conventional and mechanized methods of raising , various stopping methods, Sampling, Problems associated with deep mining, rockmechanics and stratacontrol measures in deep mines.

5. MINE ENVIRONMENTAL ENGINEERING - 1

Ventilation, objectives/purposes of ventilation, systems of ventilation - natural ventilation and mechanical ventilation. Distribution of mine alr, ventilation devices, construction location and application. Auxiliary ventilation, Booster ventilation, Homotropal, anti-tropal systems, Gas detectors- types, uses, application, principles, determination percentage of gases using conventional methods and using detectors,

6. MINE ENVIRONMENTAL ENGINEERING - 2

Mine fires, classification, causes preventive measures. spontaneous heating of coal, different methods of dealing with fires, Collection of air samples and interpretation of Mine air samples, , Ventilation survey , types, instruments, Mine Explosions – Types, Fire damp explosions-causes and preventive measures, Coal dust explosions- causes and preventive

measures, treating coal dust, dust barriers, water barriers. Rescue and Recovery. Operations, objectives, classification of rescue apparatus, Resucitation apparatus, rescue organization. Inundation in mines, its causes, precautions, design of dams. Mine lighting, purpose, Terms, Places to be illuminated in the mines. Flame safety lamp- Different types, construction details. Miners diseases, causes and preventive measures.

7. MINE SURVEYING:

Definitions, Principles, classifications, Measurement of distances. Various instruments used in Surveying, chain survey, Fundamentals of compass survey, limitation of various surveying methods, various methods of leveling, types of levels, instruments, adjustments, computations, theodolite types, adjustments, traversing and computations, setting out curves, types, correlation survey, tachometric survey and triangulation Survey.

8. MINING MACHINERY - 1

Wire ropes- usage, chemical composition, tests of wires, classification, applicability of different wire ropes, causes of deterioration and precautions, capping, recapping methods and rope splicing, Transportation in mines - classification different types of rope haulages, their applicability, merits and demerits limitations. Safety devices in different rope haulages, Locomotive haulages- types, applicability's, Conveyors- types, tensioning arrangements, use and applicability in mines, Aerial ropeways, man riding applicability's, Pumps their applicability in mines, construction details merits, demerits and limitations.

9. **MINING MACHINERY - 2**

Coal face machinery, different Drills, Power loaders, Longwall face machinery-AFC , lump breakers, stage loaders, power pack, SERDS,DERDS, safety devices, power support, Mine cables- types, constructional details, Flame proof apparatus and Intrinsically safe apparatus-field of applications, features, remote control principle, Signaling methods used in mines, telephones, Winding -purpose, equipment, types of headgear frames, shaft fittings, guides, Pit top and pit bottom arrangements, keps, suspension gear, types of drums, drum and skip winding, Cage winding and Friction (Keope Winding) speed control and safety contrivances.

10. MINING LEGISLATION AND MINE MANAGEMENT:

Mines-Act, Mine-Rules and regulations provisions of Mine Act in respect of drinking water, Health, Hygiene, etc., Medical facilities. Limitations of employment, leave with wages, etc., Coal Mines/Metal Mines Regulations - Definitions duties of manager, over man, safety officer, under manager etc., Transport, Mine working ventilation etc., Precautions against dangers from fire, dust gas, water etc., Mine lighting and safety. Industrial Dispute Act, Causes disputes work committee, strikes, lock out. Mine Management-Organization structure, safety in mines and Mine accidents. Entrepreneurship, self employment scheme, market and demand survey, quality systems concepts, quality policy, quality control, quality assurance, ISO 9000, features, draw backs, recruitment, qualifications, training programmes, work-study.

12. ELECTRONICS AND INSTRUMENTATION ENGINEERING

UNIT-1: Electrical Engineering: Ohm's law- Kirchhoff's law- star –delta transformation-basics of D.C Machines, motors and generators-A.C. machines-Thevenin's and Norton's theorems.

UNIT-2: Industrial electronics and control engineering:.-Photo transistor, photo conductive device , photo multiplier , solar cell , opto-coupler, dot matrix and seven segment displays, bar graph, basic principles of induction heating, dielectric heating and resistance welding, generation and applications of ultrasonics.- basics of open loop and closed loop control systems-Transfer functions-signal flow graphs-Time response of first order and Second order system-concept of stability (Routh Hurwitz and Root locus)

UNIT-3: Electronics: Resistor, capacitor and inductor specifications and applications of transformers, basics of switches , fuses , relays and microphones , Semi conductor materials, PN junction formation, forward and reverse biasing voltages, formation ,working and configurations of PNP and NPN transistors , Zener diode , FET , MOSFET , UJT , diode as rectifier ,C,LC and CLC filter circuits , RC coupled amplifier , transformer coupled amplifier , Darlington and cascaded amplifier , Class-A and Class-B push-pull amplifier , complementary type power amplifier, oscillator principle , RC phase shift and wien bridge oscillator , Boot strap sweep circuit , miller sweep circuit , bistable , astable and monostable multivibrator using transistor.

UNIT-4: Digital Electronics: Number systems , logic gates , half adder and subtractor , full adder , RS, T , D and Master-slave JK type flip-flops , counters, up/down counter , ring counter , Registers , shift registers , universal shift register , basic memories (RAM and ROM) , ADC (Counter method, Successive approximation method) and DAC.(R-2R method, Binary weighted method)

UNIT-5 Electronic Measuring instruments: Analog Instruments – Extension of range of Ammeter, Voltmeter and Ohmmeter – FET voltmeter – Differential voltmeter – Digital instruments – Ramp – Dual Slope integration – successive approximation – digital frequency meter. CRO – CRT – time base generator – deflection sensitivity – triggered sweep circuits – CRO applications -AF Oscillator – RF Signal generator – AF and RF Power meters – Q meter – Distortion Factor Meter – Digital IC tester – Logic and Spectrum Analyzer.

UNIT-6: Process Instrumentation: Fundamentals of instrumentation , basic transducer theory for the measurement of displacement(LVDT, Potentiometer, inductive, capacitive,), angular velocity, temperature (Thermometers, RTD, Thermo couple,thermister,Pyrometers), pressure (elastic elements, Strain gauge,piezo electric) , Flow (Head type flow meters, rotameter, Electromagnetic flow meter, anemometers, Ultrasonic flow meter) , PH , conductivity , weight , humidity , level , viscosity and density , detection of alpha, Beta and Gamma particles ,

UNIT-7: Process Control: On-off Control, Proportional, Integral and Derivative Controllers, PID Controller, Tuning of PID Controller, Actuators (Pneumatic, electro-pneumatic Hydraulic) basics of control valves, Cascade Controller, Ratio Controller, Adaptive Control, Line Diagrams, Letter Codes, Basic of CNC Machine, Basics of Robot.

UNIT-8: Communications and Linear IC Applications: Need and Types of Modulation, SSB, DSB and VSB transmission, AM and FM Transmitters, AM and FM Detectors, Basics of Pulse Modulation and Applications, Optical Fibre Communication, , Characteristics of Operational Amplifier, Applications of Operational Amplifier like (Summer, Integrator, Differentiator, Inverter, Voltage Follower, V to I Converter, I to V Converter, Comparator, Square wave Generator, Mono Stable Multivibrator, Astable multivibrator, Wienbridge Oscillator, Instrumentation Amplifier, Schmitt Trigger, ADC and DAC), Applications of 555 timer, Phase locked loop.

UNIT-9: Analytical and biomedical instrumentation: Electromagnetic Spectrum, Beer Lamberts Law, Mono Chromator, Light Sources and Detectors, Spectrophotometer (UV, Visible, IR), Flame Photometer, Spectroflourometer, Polarimeter, Gas Analyzer, Mass Spectrometer, Liquid Chromatography and Gas Chromatography, Basics of Diagnostic Equipment ECG , EEG,EMG Blood flow measurement, Pace Maker, Defibrillator, X-Ray Equipment., CAT

UNIT-10: **Microcontroller & PLCs:** Architecture and Instruction set of 8051 Micro controller, interfacing peripherals (8255, 8251, 8257 and 8259) and applications of 8051.Basics of PLC-Architecture and instruction set of PLC and applications.

13. CERAMIC TECHNOLOGY

1. GEOLOGY AND MINERALOGY OF CERAMIC RAW MATERIALS: Definition of Geology, Petrology and Mineralogy, Ceramic minerals, Ceramic Clays and their classification, Physical properties of Clays, Grog and its properties, Types of Silica Minerals, Types of Alumina Minerals, Feldspar group Minerals, Carbonate minerals, Bone ash, Fly ash**.**

2. WHITE WARE & HEAVY CLAY WARE: Machinery and equipment used in ceramic industry. Body preparation. Fabrication methods. Drying of Clay products. Setting and Firing of Clay products. Classification of Earthenware, Porcelain ware, Special Porcelain ware, Bone china, Sanitary ware, Heavy Clay ware, Floor and Wall Tiles. Glazes, Frits, Colors and decoration. Quality control.

3. REFRACTORIES: Classification, properties and Fabrication techniques of Refractories. Insulating Refractories. Kiln furniture and accessories. Refractory Cements and mortors.Alumino silicate Refractories, Silica Refractories, Dolomite Refractories,Magnesite Refractories,Chrome-Magnasite Refractories, Mag-Chrome Refractories, Carbon Refractories, Chromite Refractories. Super Refractories properties and uses.

4. GLASS TECHNOLOGY: Raw materials, Classification of glass making raw materials, Batch preparation, weighing, mixing, Conveying and Charging, Glass melting process, Types of furnaces, Types of fabrication techniques for Containers, Sheet glass, Float glass,optical glasses,safety glass,Tubes, Annealing, Tempering, Decoration, Testing and Quality Control of glass, Special glasses, Heat resistant glasses, Fiber glass, Glass ceramics.

5. CEMENT TECHNOLOGY: Raw materials, lime stone and limes, Batch preparation, Mixing, Types of manufacturing process, Natural Cements, Portland Cements, Special Cements, Rotary kiln.

6. ADVANCED CERAMICS: Purification of raw materials, shaping techniques, and firing techniques, Electrical Ceramics, Electronic Ceramics, Ceramic Composites, Magnetic Ceramics, Nuclear Ceramics and other Structural Ceramics. Stabilised Zirconia and products, Alumina products.

7. FUELS, FURNACES & PYROMETRY: Construction and working of Industrial Pyrometers, furnaces used in glass industry, enamel industry, Kilns used in Ceramic industry, Types of fuels, Advantages and disadvantages of different physical state of Fuels, Combustion, Classification of fuels, NCES & RES, Hydrogen gas.

8. ENAMELS AND GLAZES: Raw materials, Enamel Compositions, Batch preparation, Metal treatment of enamels, Application of enamel and firing of enamels, Defects and decoration, Batch compositions of glazes, Glaze preparation, Firing, Defects and testing of Lead glazes, Leadless glazes, Feldspathic & Calcareous glazes.

14. BIO – TECHNOLOGY

1. **Basic Industrial Biotechnology:** Production Strains, Production media, Types of Media, Carbon, Nitrogen Sources, Biopesticides, Biofertilizers.

2. **Bio-Physics:** Bio-Physics and Cell doctrine, Cell theory and Atomic theory, types of microscopes, Biological membranes, Applications of Bio-Physics.

3. **Genetics and Cell Biology:** Mendelism and its variations, Linkage, Cell division, Chromosome Structure, Chromosome Aberrations, Genetic mechanism of Sex Determination, Sex-Linked genes, holandric genes.

4. **Microbiology:** Classification of Micro Organisms, Nutrition in Micro Organisms, Growth - measurement of microbial growth, culture media, synthetic complex media, Importance and isolation of pure cultures and primary stock cultures, preservation of cultures, control of micro organisms, dis-infection and sterilization methods, chemical agents, physical agents, different classes of disinfections.

5. **Bio-Reactor Engineering:** Classification of bioreactors, Energy balance of bioreactors, selectivity and optimization of bioreactors, design and analysis of bioreactors, introduction to microprocessors and their applications in bioreactors control, safety regulations and decontamination procedures practiced in the operation of bioreactors.

6. **Molecular Biology - Genetic Engineering:** Nucleic acids - Structure of DNA, RNA, replication of DNA, Organisation of nuclear genome, gene numbers, essential and non-essential genes, charge ff rule, one gene, one enzyme hypothesis - Phenyl ketonuria, alkaptonuria and albinism, protein synthesis, applications of Genetic Engineering.

7. **Plant Bio-Technology:** Tissue culture, techniques, application of plant tissue culture, protoplast technology - isolation, culture of protoplasts, regeneration of cell wall and callus formation - protoplast fusion. Genetic engineering through plasmids, Ti Plasmid, gene transfer in plants - Symbiotic N_2 fixation, plant protection, applications - methods.

8. **Animal Bio- Technology:** Animal cell and tissue culture, Animal organ culture techniques - Advantages - Limitations and applications, production of transgenic animals by microinjection, future prospects of transgenesis, Cell culture products.

9. **Bio-Informatics:**Bio-Informatics in biology and medicine, bio-molecules and bio-polymers, genome analysis.

10. **Enzyme Engineering:**Classification of Enzymes, Applications, Physical and Chemical techniques for enzyme immobilization - advantages and disadvantages of immobilization techniques. Structure of Enzymes - Primary and secondary structure and peptide bond.

15. PHARMACEUTICS-I

1. Introduction of different dosage forms. Their classifications with examples-their relative applications. Familiarisation with new drug delivery systems.
2. Introduction to Pharmacopieas with special reference to the Indian Pharmacopea.
3. Metrology-Systems of weights and measures. Calculations including conversion from one to another system. Percentage calculations and adjustments of products. Use of allegation method in calculations, Isotonic solutions.
4. Packing of pharmaceuticals-Desirable features of a container-types of containers, study of glass and plastics as materials for containers and rubber as a material for closures-their merits and demerits. Introduction to aersol packaging.
5. Size reduction Objectives and factors affecting size reduction, methods of size reduction-Study of Hammer mill, ball mill, Fluid Energy Mill and Disintegrator.
6. Size separation- Size separation by sifting Official Standard for powders. Sedimentation methods of size separation. Construction and working of cyclone separator.
7. Mixing and Homogenization-Liquid-mixing and powder mixing. Mixing and semisolid, Study of Siliver –son Mixer-Homogeniser, planetary Mixer, Agitated powder mixer. Triple Roller Mill, Propeller Mixer-Coiloid Mill and Hand Homogeniser. Double cone mixer.
8. Clarification and Filtration-Theory of filtration. Filter media; Filter aids and selections of filters. Study of the following filtration equipments Filter Press, Sintered Filter, Candles , Metafilter.
9. Extraction and Galenicals-(a) Study of percolation and maceration and their modification, continuous hot extraction-Applications in the preparation of tinctures and extracts.
   (b)Introduction to Ayurvedic dosage forms.
10. Heat process Evaporation- Definition Factors affecting evaporation Study of evaporation and Evaporating pan.
11. Distillation-simple distillation and Fractional distillation, Steam distillation and vaccum distillation Study of Vaccum still, preparation of Purrified Water I.P and water for Injecion I.P. Construction and working of the still used for the same.
12. Introduction to drying process- Study of Tray Dryers; fluidized Bed Dryer, Vaccum Dryer and Freezer Dryer.
13. Sterlization – Concept of sterilization and its differences from disinfection – Thermal resistance of micro-organism. Detailed study of the following sterilization process.
    (i) Sterilization with moist heat.
    (ii) Dry heat sterilization.
    (iii) Sterilization by radiation.
    (iv) Sterilization by filtration and
    (v) Gaseous sterilization
    Aseptic techniques. Application of sterilization process in hospitals particularly with reference to surgical dressings and intravenous fluids. Precautions for safe and effective handling of sterilization enquipments.
14. Processing of tablets-Definition; Different types of compressed tablets and their properties. Processing involved in the production of tablets; Tablets; Physical Standards including Disintegration and Dissolution. Tablet coating-sugar coating; Film coating, enteric coating and, microencapsulation. Tablet coating may be dealt in an elementary manner.

15. Processing of Capsules- Hard and Soft gelatin capsules; different sizes capsules; filling of capsules; handling storage of capsules; Special application of capsules.
16. Study of immunological products likes sera vaccines, toxoids& their preparations.

PHARMACEUTICS - II

1. Dispensing pharmacy:

(i) Prescriptions: Reading and understanding of prescription: Latin terms commonly used (Detailed study is not necessary), Modern methods of prescribing, adoption of metric system. Calcuations involved in dispending.

(ii) Incompatabilities in Prescriptions – Study of various types of incompatabilities –

Physical, chemical and therapeutic.

(iii) Posology – dose and Dosage of durgs, Factors influencing dose, Calculations of doses on the basis of age, sex and surface area, Veterinary doses

2. Dispensed Medications:

(Noted: Adetailed study of the following dispensed medication is necessary. Methods of preparation with theoretical and practical aspects. Use of appropriate containers and closures, Special labeling requirements and storage conditions should be highlighted).

(i) Powders: Types of powders – Advantages and disadvantages of powders. Granules.

Cachets and Tablet triturates. Preparation of different types of powders encountered

in prescription Weighing methods, possible erros in weighing , minimum weighable

amounts and weighing of material below the minimum weighable amount, geometric

dilution and proper usage and care of dispensing balance.

(ii) Liquid Oral Dosage Forms:

(a) Monophasic – Theoretical aspects including commonly used vehicles, essential

adjuvant like stabilizers, colourants and flavours, with examples.

Review of the following monophasic Liquids with details of formulation and practical

methods.

Liquids of internal	Liquids for external administration or used on mucus membranes
mixtures and concentrates	Gargles
syrups	Mouth washes
	Throat Paints Douches
Elixirs	Ear Drops nasal drops & Sprays
	Liniments Lotions.

(b) Biphasic Liquid Dosage Forms:

(i) Suspensions (elementary study)- suspensions containing diffusible solids and liquids and their preparations. Study of the adjutants used like thickening agents, wetting agents, their necessity and quantity to be incorporated suspensions of precipitate forming liquids like Tinctures, their preparations and stability. Suspension produced by chemical reaction. An introduction to flocculated, non- flocculated suspension system.

(ii) Emulsions – Types of emulsions, identification of emulsion system tormulation of emulsions, selection of emulsifying agents Instabilities in emulsions. Preservationof emulsions.

(iii) Semi- Sold Dosage Forms:

a) Ointments – Types of ointments, classification and selection of dermartological vehicles. Preparation and stability of ointments by the following process.

(i) Tritutration (Fusion) (iii)Chemical reaction (iv) Emulsification.

(b) Pastes –Difference between ointments and pastes. Bases of pastes. Preparation of pastes and their preservation.

(c) Jellies-An introduction to the different types of jellies and their preparation.

(d) An elementary study of poultice.

(e) Suppositories and pessaries -their relative merits and demerits. Types of suppositories, suppository bases, classification, Properties, preparation and packing of suppositories, Use of suposiories for Drug absorption.

(iv) Dental and cosmetic Preparations:
Introduction to Dentrifices, Facial cosmertics, Deodorants, Antiperspirats, Shamjpoos, Hair dressings and Hair removers.

(v) Sterile Dosage Forms:

(a) Parenteral dosage forms- definitions. General requirements for parenteral dosage forms, Types of parenteral formulations, vehicles, adjuvants, processing personnel, facilities and Quality control. Preparation of intravenous fluids and admixtures. Total parenteral nutrition,dialysis fluids.

(b) sterility testing, particulate matter monitoring faulty. seal packaging.

(c) Ophthalmic products-study of essential characteristics of different opthalmic preparations.Formulation additives.special precautions in handling and storage of ophthalmic products.

PHARMACEUTICAL JURISPRUDENCE

1. Origin and nature of pharmaceutical legislation in India, its scope and objectives, Evolution of the "Concept of Pharmacy" as an integral part of the Health Care Dystem.
2. Principles and significance of Professional Ethics, Critical study of the code of pharmaceutical Ethics drafted by Pharmacy Council in India
3. Pharmacy Act, 1948 – General study of the Pharmacy Act with special reference to Education Regulations, working of State and Central Councils, constitution of these councils and functions, Registration procedures under the Act.
4. The Drugs and Cosmetics Act,.1940 – General study of the Drugs and Cosmetics Act the Rules hereunder. Definitions and salient features related to retail and wholesale distribution of drugs. The powers of Inspectors, the sampling procedures and the procedure and formalities in obtaining licenses under the rule. Facilities to be provided for fuinning a Pharmacy effectively. General study of the Schedules withs sprcial reference of schedules C, C1, F.G, J, H, P and X and salient features of labeling and storages condition of drugs.
5. The Drugs and Magic Remedies (Objectionable Advertisement) Act, 1954 – General study of the Act Objective, special reference to be laid on advertisements. Magic remedies and objectionable and permitted advertisements – disease which cannot be claimed to be cured.
6. Narcotic Drugs and Psychotropic Substances Act, 1985 –A brief study of the act with special reference to its objectives, offences and punishment.
7. Brief introduction of the study of the following acts.
   i) Latest Drugs (Price Control) Order in force.
   ii) Poisons Act 1919 (as amended to date)
   iii) Medicinal and Toilet Preparations (Excise Duties) Act, 1971 (as amended to date)
   iv) Medical Termination of Pregnancy Act. 1971 (as amended to date)

16. PHARMACEUTICAL CHEMISTRY-I

1. General discussions on the following inorganic compounds including important physical and chemical properties, medical and pharmaceutical uses, storage conditions and chemical incompatibility.

(A) Acids, bases and buffers Boric Acid, Hydrochloric acid, strong ammonium hydroxide. Calcium hydroxide. Sodium hydroxide and official buffers.

(B) Antioxidants – Hypo phosphorous acid, Sulphur dixide, Sodium bisulphate, Sodium metabisulphite, Nitrogen and Sodium Nitrite.

(C) Gastrointestinal agents:-

I. Acidifying agents Dilute hydrochloric acid.

II. Antacids-sodium bicarbontate, Aluminium hydroxide gel, Aluminium phosphate, Calcium carbonate, Magnesium carbonate, Magnesium trisilicate, Magnesium Oxide, Combinations of antacid preparations

III. Protectives and Adsorbents-Bismuth subcarbonate and Kaolin.

IV. Saline Cathartics-Sodium Patassium tartate and Magnesium sulphate.

(D) Topical Agents:-

I. Protectives-Talc, Zinc Oxide Calamine, Zinc stearate , Titanium dioxide, silicone polymers.

II. Antimicrobials and Astringents-Hydrogen peroxide, Potassium permagnate, Chlorinated lime, Iodine, Solutions of Iodine, Povidone-Iodine, Boric acid, Borax, Silver nitrate, Mild silver proein, Mercury, Yellow mercuric oxice, Ammoniated mercury.

III. Sulphur and its compounds-Sublimed sulphur precipitated sulphur, seleniumsulphide.

IV. Astringents:- Alum and Zinc Sulphate.

(E) Dental Products-Sodium Flouride, Stannous Flouride, Calcium carbonate, Sodium metaphosphate, Dicalcium phosphate, Strontium chloride, Zinc chloride.

(F) Inhalants-Oxygen, Carbon dioxide, Nitrous oxide.

(G) Respiratory stimulants-Ammonium carbonate

(H) Expectorants and emetics – Ammonium chloride, potassium lodide, Antimony potassium tartrate.

(I) Antidotes-Sodium nitrate

2. Major intra and Extcracellular electrolytes:-

(A) Electrolytes used for replacement the rapy-Sodium chloride and its preparation. Potassium chloride and its preparation.

(B) Physiological acid-base balance and electrolytes used-Sodium acetate, Patassium acetate, Sodium bicarbonate injection, Ammonium chloride and its injection.

(C) Combination of oral electrolyte Powder and Solutions.

3. Inorganic Official compounds of iron, Iodine, and Calcium Ferrous Sulphate and Calcium gluconate.

4. Radio pharmaceuticals and Contrast media-Radio activity-Alpha, Beta and Gamma Radiations, Biological effects and Radiations Measurements of radio activity, G.M Counter Radio isotopes their uses, storage and precautions with special reference to the official preparations.

5. Quality control of Drugs and Pharmaceuticals-Importance of quality control, significance efforts, methods used for quality control, sources of impurities in pharmeceuticals. Limit tests for Arsenic Chloride, sulphate, Iron and Heavy Metals.

6. Identification tests for cations and anions as per Indian pharmacopeia.

PHARMACEUTICAL CHEMISTRY - II

1. Introduction to the nomenclature of organic chemical systems with particular reference to heterocyclic system containing upto 3 rings.
2. The Chemistry of following Pharmaceutical organic compounds. Covering their nomenclature, chemical structure, uses and the important Physical and Chemical Properties. (Chemical structure of on those compounds marked with asterisk. (*)
   The stability and storage conditions and the different type of Pharmaceutical formulations of these drugs and their popular brand names.
   Antiseptics and Disinfectants – Proflavine * Benzal - koniumchloride, cetrimide, chlorocresol * Chloroxylene, Formaldehyde solution, Hexachlorophene, Liquified phenol, Nitrofurantoin
   Sulfonamides – Sulfadiazine Sulfaguandine*
   Phthalylsulfathiazole, Succinylsulfathizole. Sulfadimethoxazole, Cotrimoxazole, Sulfacetamide* Antileprotic Drugs – Clofazime, Thaimbutosine, Dapsone* Solapsone. Anti – tubercular Drugs – Isoniazed * PAS*, Streptomycin, Rifampicin, Ethambutol* Thiacetazone, Ethionamide, Cycloserine, Pyrazinamide*.
   Antiamoebic and Anthelmintic Drugs –Emetine, Metronidazole* Halogenated hydroxyquinolines, diloxanidefuroate, paramomycin Piperzine* Mebandazole, D.E.C..*
   Antibiotics – Benzyl Pencillin*, Phenoxy methyl Pencillin*, Benzathine Pencillin, Ampicillin*, Cloaxocillin, Carbencillin, Gentamicin, Neomycin, Erythromycin, Tetracycline, Cephalexin, Cephaloridine, Cephalothin, Griseofuivin, Chloramphenical.
   Antifungal agents – Undecylenic acid, Tolnaftate, Nystain, Ampthotericin Hamycin
   Antimalarial Drugs – Chloroquine, Amodiaquine, Primaquine, Triflu Perazine, Thiothixene, Haloperidol. Triperidol, Oxypertine, Chlordiazepoxide, Diazepam, Lorazepam, Meprobamate.
   Hypnotics:- Phenobarbitone, butobarbitone, Cyclobarbitone, Nitrazepam, Gluthethimide*, Methypylone, Paraldelnyde, Triclofos sodium, General Anaesthetics – Halothane*, Cyclopropane*, Diethlehter*, Methohexital sodium, Thiopental sodium Trichloroethylene.
   Antidepressant Drugs -Amitriptyline, imipramine* pheneizine, Tranylcypromine.
   Analeptics-Theophyline, Caffeine*, Coramine*, Coramine*, Dextroamphetamine Adrenergic Drugs- Adrenaline*, Noradrenaline, Isoprenaline*, Phenylephrine, Salbutamol, Terbutaline, Ephedrine*, Pseudoephedrine. Adrenergic Antagonist – Tolazoline, Propranolol*, Practolol.
   Cholinergic Drugs-Neostigmine*, Pyridostigmine, Pralidoxime, Pilocarpine, Physostigmine*.

   Cholinergic antagonists-Atropine*, Hysocine, Homatropine, Propantheline*, Benztropine, Tropicamide, Biperiden*, Diuretic Drugs- Furosemide*, Chlorothiazide, Hydrochlorothiazide*, Benzthiazide, Urea*, Mannitol*, Ethacrynic Acid.
   Cardiovascular Drugs- Ethyl nitrite*, Glyceryl Trinitrate, Alpha methyldopa, Guanthidine, Chlorpropamide*, Tolbutamide, Glibencalmide, Phenformine*, Metformin.
   Coagulants and Anti-Coagulants-Heparin, Thrombin, Menadione,*, Bishydroxycoumarin, warfarion sodium. Local Anesthetics lignocaine procaine,Benzocaine Histamine And – histaminic Agents – Histamine, Diphenhydramine*, Promethzine Cyproheptadine, Mepyramine, Pheniramine, Chlorpheniramine*.
   Analgesics and Anti-pyretics-Morphin, Pethidine*, Codeine, Methadone, Aspirin*, Paracetamol*, Analgin, Dextropropoxyphene. Pentazocine. Non-steroidal anti –inflammatory Agents-indomethacin*, Phenyl butazone oxyphenbutezone lbuprofen Thyroxineand Antithyroids-Thyroxine, Methimazole Methylthiouracil, Propylthiouracil Diagnostic Agensts-lopanoic Acid, Propyliodone Sulfobromophthalein, Sodium indigotindisulfonatae, indigo Carmine, Evansblue, Congo Red Fluorescein Sodiom.
   *Anticonvulsants, cardiac glycosides antiarrhythmic antihypertensives & vitamins.
   Steroidal drugs –Betamethazone, Cortisone, Hydrocortisone Prednisolone, Progesterone, Testosterone, Oestardiol, Nandrolone Anti-Neoplasic Drugs-Actinomycines, Azathioprine, Busulphan, Chloarambucil. Cisplatin Cyclophosphamide, Dau norubiein, hydrochloride Flurouracil, Meracaptopurine, Methotrexate, Mytomycin,

1. Introduction to biochemistry.
2. Brief chemistry and role of proteins, polypeptides and amino acids, classifications, Quantitative tests, Biological value, Deficiency diseases.
3. Brief Chemistry and role of carbohydrates, Classification qualitative tests, Diseases related to carbohydrate metabolism.
4. Brief Chemistry and role of Lipids, Classification, Qualitative tests, Diseases related tolipid metabolism.
5. Brief Chemistry and role of vitamins and Coenzymes.
6. Role of minerals and water in life processes
7. Enzymes; Brief concept of enzymic action. Factors affecting it. Therapeutic and pharmaceutical importance.
8. Brief concept of normal and abnormal metabolism of proteins, carbohydrates and lipids.
9. Introduction to pathology of blood and urine.
   (a) Lymphocytes and Platelets, their role in health and disease.
   (b) Erythrocytes Abnormal cells and their significance.
   (c) Abnormal constituents of urine and their significance in diseases.

17. PHARMACOGNOSY

1. Definintion, history and scope of Pharmacognosy including indiaenous system o medicine.
2. Various systems of classification of drugs of natural origin.
3. Adultration and drug evaluation; significance of Pharmacopial standards.
4. Brief outline of occurrence, distribution, outline of isolation, identification tests, therapeutic and pharmaceutical applications of alkaloids, terpenoids, glycosides, volatile oils, tannins and resins.
5. Occurrence, distribution, organoleptic evaluation, chemical con-stituents including tests wherever applicable and therapeutic efficacy of following categories of drugs.
   (a) Laxatives: Aloes, Rhubarb, Castor oil, Ispaghula. Senna.
   (b) Cardiotonics- Digitalis, Arujna.
   (c) Carminatives & G.I regulators- Umbelliferous fruits, Cariander, Fennel, Ajowan, Cardamom Ginger. Black pep-per, Asafoetida, Nutrneg, Cinnamon, Clove.
   (d) Astringents – Catechu.
   (e) Drugs acting on nervous system –Hyoscyamus, Belladona, Aconite, Ashwagandha; Ephedra, Opium, - Cannabis, Nuxvomica.
   (f) Antihypertensives – Rauwolfia.
   (g) Antitussive – Vasaka, Tolu balsam, Tulsi.
   (h) Antirheumatics – Guggul, Colchicum.
   (i) Antitumour – Vinca.
   (j) Antileprotics – Chaulmoogra Oil.
   (k) Antidiabetics – Pterocarpus, Gymnema, Sylestro.
   (l) Diuretics – Gokhru, Purnarnava.
   (m) Antidysentries – Ipecacuanha.
   (n) Antiseptics and disinfectants Benzion, Myrrh, Nim, curcuma.
   (o) Antimalarials – Cinchona.
   (p) Oxytocics – Ergot
   (q) Vitamins – Shark liver Oil and Amla.
   (r)Enzymes – Papaya, Diastase, Yeast.
   (s) Perfumes and flavouring agents – peppermint Oil, Lemon Oil, Orange, grass Oils, Sandalwood.
   (t) Pharmaceutical aids – Honey arachis Oil, Strach, Kaolin, Pectin, Oliveoil, Lanolin, Beeswax, Acacia, Tragacanth, Sodium alginate, Agar, Guar gum, Gelatin.
   (u) Miscellaneous – Liquorice, Garlic, Picrorhiza, Dioscorea, Linseed. Shatavari, Shanknapushpi, Pyrcthrum, Tobacco.
6. Collection and preparation of crude drug for the market as exemplified by Ergot opium; Rauwolfia, Digitalis, Senna.
7. Study of source preparation and identification of fibres used in sutures and surgical dressings – cotton, silk, wool and regenerated fibre.
8. Gross anatomical studies of Senna, Datura, Cinnamon, Cinchona, Fennel, Clove, Ginger, Nuxvomica & Ipecacuanha.

1. Introduction – Trade, industry and Commerce, Functions and subdivision of commerce, introduction of Elements of Economics and management
2. Forms of Business Organizations.
3. Channels of Distribution.
4. Drug House Management -Selection of Site, Space Lay-out and legal requirements.
   Importance and objectives of purchasing, selection of suppliers, credit information, tenders contract and price determination and legal requirements there to.
   Codification, handling of drug stores and other hospital supplies.
5. Inventory Control – objects and importance, modern techniques like ABC, VED analysis, the lead time, inventory carrying cost, safety stock, minimum and maximum stock levels, economic order quantity, scrap and surplus disposal.
6. Sales promotion, Market Research Salesmanship, qualities of salesman, Advertising and Window Display.
7. Recruitment, training, evaluation and compensation of the pharmacist.
8. Banking and Finance Service and Functions of bank. Finance planning and sources of finance. Part-II Accountancy
   1. Introduction to the accounting concepts and conventions. Double entry book keeping different kinds of Account.
   2. Cash Book
   3. General Ledger and Trial Balance Sheet
   4. Profit and Loss Account and Balance Sheet
   5. Simple technique of analyzing financial statements

   Introduction to Budgeting

1. Concept of health- Definition of Physical health, mental health, social health, spiritual health determinants of health, indicator of health, concept of disease, natural history of diseases, the disease agents, concept of prevention of diseases.
2. Nutrition and health- Classification of foods requirements, disease induced due to deficiency of proteins, Vitamins and minerals treatment and prevention.
3. Demography and family planning – Demography cycle, fertility, family planning, contraceptive methods, behavioral methods, natural family planning method, chemical method, mechanical methods, hormonal contraceptives, population problem of India.
4. First aid – Emergency treatments in shock, snake bite, burns poisoning heart disease, fractures and resustication methods. Elements of minor surgery and dressings.
5. Environments and health – Sources of water supply, water pollution, purification of water, health and air, noise light soild waste disposal and control, medical entomology, arthropod borne disease and their control, rodents, animals and diseases.
6. Fundamental Principles of microbiology classification of microbes, isolation, staining techniques of organisms of common diseases.
7. Communicable diseases – Causative agents, modes of transmission and prevention.
   (a) Respiratory infection – Chicken pox, measles, Influenza, diphtheria whooping cough and tuberculosis.
   (b) Intestinal infections; Poliomyitis, Hepatitis, Cholera, Typhoid, Food Poisioning, Hookworm infection.
   (c) Arthropod borne infections – plague, Malaria; Filariasis.
   (d) Surface infection – Rabies, Trichoma, Tetanus, Leprosy.
   (e) Sexually transmitted disases – Syphilis, Gonorrhoea, AIDS.
8. Non- communicable diseases – causative agents, prevention, care and control. Cancer, Diabetes; Blindness, Cardiovasodlar diseases.
9. Epidimiology its scope, methods uses dynamics of diseases of transmission immunity and immunization; Immunological products and their dose schedule, principles of disease control and prevention, hospital acquired infection, prevention and control, Disinfection, types of disinfection, disfection procedures, faeces urine, sputum, Icomlinen, dead-bodies, instruments.

HUMAN ANATOMY AND PHYSIOLOGY THEORY

1. Scope of Anatomy and Physiology, Definition of various terms used in Anatomy.
2. Structure of cell, function of its components with special reference to mitochondria and micorsomes.
3. Elementary tissues of body, i.e. epithelial tissue, muscular tissue, connective tissue and nervous tissue.
4. Structure and function of skeleton, Classification of joints and their function, joint disorder.
5. Composition of blood, functions of blood elements. Blood groups and coagulation of blood. Brief information regarding disorders of blood.
6. Name and functions of lymph glands.
7. Structure and functions of various parts of the heart. Arterial and venous system with special reference to the names and positions of main arteries and viens. Blood pressure and its recording. Brief information about cardiovascular disorders.
8. Various parts of respiratory system and their functions, Physiology of respiration.
9. Various parts of urinary system and their functions, structure and functions of kidney, physiology of Urine formation, Pathophysiology of renal diseases and oedema.
10. Structure of skeletal muscle. Physiology of muscle contraction Names position, attachments and functions of various skeletal muscles Physilogy of neuromuscular junction.
11. Various part of central nervous system, brain and its parts functions and reflex action. Anatomy and Physiology of automatic nervous system.
12. Elementary knowledge of structure and functions of the organs of taste, smell, ear, eye and skin, Physiology of pain.
13. Digestive system; names of the various parts of digestive system and their functions of liver, physiology of digestions and absorption.
14. Endocrine glands and Hormones. Locations of the glands, their hormones and functions. Pitutary, thyroid, Adrenal and pancreas.
15. Reproductive systems – Physiology and Anatomy and Reproductive system.

18. PHARMACOLOGY AND TOXICOLOGY

1. Introduction to Pharmacology, scope of pharmacology.
2. Routes of administration of drugs their advantages and disadvantages.
3. Various processes of absorption of drugs and the factors affecting them, Metabolism, distribution and excretion of drugs.
4. General mechanism of drugs action and the factors which modify drug action
5. Pharmacological classification of drugs. The discussion of drugs should emphasise the following aspect:
   i) Drugs acting on the Central Nervous System:
   a) General anaesthetics, adjunction to anaestheasia intravenuous anaesthetics.
   b) Analgestic antipyretics and non-steroidal anti- inflammatory drugs, Narcotic analgestics, Antirheumatic and antigout remedies, Sedatives and Hypnotics.
   c) Centrally acting, muscle relaxants and anti –parkinsonism agents
   ii) Local anaesthetics.
   iii) Drug acting on autonomic nervous system
   a) Cholinergic drug, anticholinergic drugs, anticholinerserase drugs.
   b) Adrenergic drugs and adrenergic receptor blockers.
   c) Neurone blockers and ganglion blockers,
   d) Neuromuscular blockers, drugs used in myasthenia gravis.
   iv) Drugs acting on eye, mydriatics, drugs used in glaucoma.
   v) Drugs acting on respiratory system-Respiratory stimulants Bronchodilators, Nasal decongestants, Expectorants and Antitussive agents.
   vi) Antacids, Physiological role of histamine and serotonin, Histamine and drugs used in atherosclerosis.
   vii) Cardio Vascular drugs, Cardio tonics, Antiarrhyhmic agents, Antianginal agents, Antihypertensive agents Peripheral Vasodilators and drugs used in atherosclerosis.
   viii) Drugs acting on the blood forming organs, Haematinics, Coagulants and anti-Coagulants, Haemostatics, Blood substitutes and plasma expanders.
   ix) Drugs affecting, renal function-Diuretics and antidiuretics.
   x) Hormones and hormone antagonists-hypoglycemic agents, Antithyroid durgs, sex hormones and oral contraceptives and laxatives, Antidiarrhoeals, Emetics, Antiemetics, Antispasmodics.
6. Chemotherapy of microbial disease: Urinary antiseptics, Sulphonamides. {emocooms. Streptomycin. Tetracylines and other antibiotics, Antitubercular agents, anti fungal agents, anti viral drugs, antileprotic drugs.
7. Chemotherapyor protozoal diseases. Anthelmintic drugs
8. Chemotherapy of cancer.
9. Disinfectants and antiseptics
   A detailed study of the action of drugs on each organ is not necessary.

HOSPITAL PHARMACY AND CLINICAL PHARMACY

Part –I Hospital pharmacy

1. Hospitals Definitions, Function, Classifications based on various criteria, organization, Management and Health delivery system in India.
2. Hospital Pharmacy:
   a) Definitions
   b) Functions and objectives of Hospital Pharmaceutical services.
   c) Location, Layout, Flowchart of material and men.
   d) Personnel and facilities requirements based on individual and basic needs.
   e) Requirements and abilities required for Hospital Pharmacists.
3. Drug Distribution system in Hospitals :
   a) Out – Patient service
   b) In –Patient services (a) types of services (b) detailed discussion of Unit system. Floor and ward stock system, Satellite Pharmacy Service, Central services, Bedside Pharmacy.
4. Manufacturing:
   a) Economical considerations, estimation of demand.
   b) Sterile manufacture – large and small volume parenterals, facilities, requirements layout production planning, man-power requirements.
   c) Non sterile manufacture-Liquid orals, externals- bulk concentrates.
   d) Procurement of stores and testing of raw materials.
5. Nomenclature and used of surgical instruments and Hospital Equipments and health accessories.
6. P.T.C (Pharmacy Therapeutic Committee), Hospital Formulary System and their organization, functioning, composition.
7. Drug information service and Drug information Bulletin.
8. Surgical dressing like cotton, gauze, bandages and adhesive tape including their pharmacopocial tests of quality. Other hospital supply e.g I.V. Sets B.G. Sets, Ryals tubes, Catheters, Syringes etc.
9. Application of computers in maintenance of records, inventory control medication monitoring, drug information and data storage and retrieval in hospital and retail pharmacy establishments.

Part –II Clinical Pharmacy:

1. Introduction to Clinical Pharmacy Practice - Definition Scope
2. Modern dispensing – Pharmacists and Patient counseling advice for the use of common drugs, medication history.
3. Common daily terminology used in the practice of medicine.
4. Disease, manifestation and Pathophysiology including salient symptoms to understand the disease like Tuberculosis, Hepatitis, Rheumatoid Arthritis, Cardiovascular diseases, Epilepsy. Diabetes, peptic Ulcer, Hyeprtension.
5. Physiological parameters with their significance.
6. Drug interactions:
   a) Definition and introduction.
   b) Mechanism of Drug Interaction.
   c) Drug – drug interaction with reference to analgesics diuretics, cardiovascular drugs. Gastro – intestinal agents, Vitamins and Hypoglycemic agents.
   d) Drug – food interaction
7. Adverse Drug Reaction:
   a) Definition and Significance.
   b) Drug – induced disease and Teratogencity.
8. Drugs in Clinical Toxicity – introduction, general treatment of poisoning systemicantidotes Treatment of insecticide poisoning, heavy metal poison Narcotic drugs Barbiturate, Organophosphours poisons.
9. Drug dependence, Drug abuse, addictive drugs and their treatment complications
10. Bio-availability of drugs, including factors affecting it.

Book recommended (Latest editions)

1. Remington's Pharmaceutical Sciences.
2. Martindale The Extra Pharmacopocia

19. B.Sc.(MATHEMATICS) GRADUATES

1. MATHEMATICS

Unit - I:

Differential Equations of First Order and First Degree: Linear Differential Equations; Differential Equations Reducible to Linear Form; Exact Differential Equations; Integrating Factors; Change of Variables; Total Differential Equations; Simultaneous Total Differential Equations; Equations of the Form $dx/P = dy/Q = dz/R$

(i) Method of Grouping (ii) Method of Multipliers

Differential Equations of the First Order but not of the First Degree: Equations Solvable for *p*; Equations Solvable for y, Equations Solvable for x; Equations that do not Contain x (or y); Equations Homogeneous in x and y; Equations of the First Degree in x and y; Clairaut's Equation

Unit - II:

Higher Order Linear Differential Equations: Solution of Homogeneous Linear Differential Equations of Order n with Constant Coefficients

Solution of the Non-homogeneous Linear Differential Equations with Constant Coefficients by means of Polynomial Operators.

(i) When $Q(x) = bx^k$ and $P(D) = D - a_0, a_0 \neq 0$

(ii) When $Q(x) = b\ x^k$ and $P(D) = a_0 D^n + a_1 D^{n-1} + \ldots + a_n$

(iii) When $Q(x) = e^{ax}$

(iv) When $Q(x) = b \sin ax$ or $b \cos ax$

(v) When $Q(x) = e^{ax}$ V where V is a function of *x*.

(vi) When $Q(x) = x$V. Where V is any function *x*.

Unit - III:

Elements of Number Theory: Divisibility, Primes, Congruences, Solutions of Congruences, Congruences of Degree 1; the Function φ(n)

Unit - IV:

Binary Operations: Definition and Properties, Tables

Groups: Definition and Elementary Properties; Finite Groups and Group Tables.

Subgroups: Subsets and Subgroups; Cyclic Subgroups

Permutations: Functions and Permutations; Groups of Permutations, Cycles and Cyclic Notation, Even and Odd Permutations, The Alternating Groups

Cyclic Groups: Elementary Properties, The Classification of Cyclic Groups, Subgroups of Finite Cyclic Groups

Isomorphism: Definition and Elementary Properties, How to show that groups are Isomorphic, How to show that Groups are Not Isomorphic, Cayley's Theorem.

Groups of Cosets: Cosets; Applications

Normal Subgroups and Factor Groups: Criteria for the Existence of a Coset Group; Inner Automorphisms and Normal Subgroups; Factor Groups; Simple Groups

Homomorphisms: Definition and Elementary Properties; The Fundamental Homomorphism Theorem; Applications.

Unit - V:

Vector Differentiation: Differential Operator; Gradient; Divergence; Curl

Vector Integration: Theorems of Gauss, Green and Stokes and Problems related to them.

Unit - VI:

The Plane: Every equation of the first degree in x, y, z represents a plane, Converse of the preceding theorem; Transformation to the normal form, Determination of a plane under given conditions.

i) Equation of a plane in terms of its intercepts on the axes.

ii) Equations of the plane through three given points.

Systems of planes; Two sides of a plane; Length of the perpendicular from a given point to a given plane; Bisectors of angles between two planes; Joint equation of two planes;

Orthogonal projection on a plane; Volume of a tetrahedron in terms of the co-ordinates of its vertices; Equations of a line; Right Line; Angle between a line and a plane; The condition that a given line may lie in a given plane; The condition that two given lines are coplanar, Number of arbitrary constants in the equations of a straight line. Sets of conditions which determine a line; The shortest distance between two lines. The length and equations of the line of shortest distance between two

straight lines; Length of the perpendicular from a given point to a given line; Intersection of three planes; Triangular Prism.

The Sphere: Definition and equation of the sphere; Equation of the Sphere through four given points; Plane sections of a sphere. Intersection of two spheres; Equation of a circle. Sphere through a given circle; Intersection of a sphere and a line. Power of a point; Tangent plane. Plane of contact. Polar plane . Angle of intersection of two spheres. Conditions of two spheres. Conditions for two spheres to be orthogonal; Radical plane, coaxial system of spheres; Simplified form of the equation of two spheres.

Unit - VII:

The Real Numbers: The algebraic and Order Properties of R; Absolute Value and Real Line; The Completeness Property of R; Applications of the Supremum Property; Intervals (No question should be set from this part).

Sequences and Series: Sequences and their Limits; Limits Theorems; Monotone Sequences; Subsequences and the Bolzano - Weierstrass Theorem; The Cauchy Criterion; Properly Divergent Sequences; Series.

Limits: Limits of Functions, Limits Theorems, Some Extensions of the Limit Concept.

Continuous Functions: Continuous Functions, Combinations of Continuous Functions; Continuous Functions on Intervals, Uniform Continuity, Definition, Non-Uniform Continuity Criteria, Uniform Continuity Theorem.

Unit - VIII:

Differentiation: The derivative, The Mean Value theorem, L'Hospital Rules, Taylor's Theorem.

The Riemann Integral: The Riemann Integral, Riemann Integrable Functions, the Fundamental theorem (Scope as in Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, published by John. Willey and Sons, Inc.)

Unit - IX:

Rings: Definition and Basic Properties, Fields.

Integral Domains: Divisors of 0 and cancellation, Integral domains, The Characteristic of a Ring.

Some Non-Commutative Examples: Matrices over a field, The Quaternions

Homomorphisms of Rings: Definition and Elementary properties; Maximal and Prime Ideals, Prime Fields

Rings of Polynomials: Polynomials in an Indeterminate, The Evaluation Homomorphisms.

Factorization of Polynomials over a field: The Division Algorithm in F[x]; Irreducible polynomials, ideal structure in F[x], Uniqueness of Factorization in F[x].

Unit - X:

Vector Spaces: Vector Spaces, Subspaces, Linear Combinations and Systems of Linear Equations, Linear Dependence and Linear Independence, Bases and Dimension

Linear Transformation and Matrices: Linear Transformations, Null spaces, and Ranges, The Matrix Representation of a Linear Transformation, Composition of Linear Transformations and Matrix Multiplication, Invertibility and Isomorphism's.

Systems of linear Equations: Elementary Matrix operations and Elementary Matrices, The Rank of a Matrix and Matrix Inverses, Systems of Linear Equations:- Theoretical Aspects, Systems of Linear Equations - Computational Aspects.

Determinants: Determinants of Order 2; Determinants of Order *n*, Properties of Determinants.

Diagonalization: Eigen values and Eigen Vectors

Inner Product Spaces: Inner Products and Norms, the Gram - Schmidt Orthogonalisation Process and Orthogonal Compliments, The Adjoint of a Linear Operator, Normal and Self - Adjoint Operators, Unitary and Orthogonal Operators and their Matrices.

20. ANALYTICAL ABILITY

1. Data Sufficiency:- A question is given followed by data in the form of two statements labeled as I and II. If the data given in I alone is sufficient to answer the question then choice (1) is the correct answer. If the data given in II alone is sufficient to answer the question, then choice (2) is the correct answer. If both I and II put together are sufficient to answer the question by neither statement alone is sufficient, then Choice (3) is the correct answer. If both I and II put together are not sufficient to answer the question and additional data is needed, then choice (4) is the correct answer.

2.

a. Sequences and Series: Analogies of numbers and alphabets completion of blank spaces following the pattern in A: b:: C:d relationship odd thing out; Missing number in a sequence or a series.

b. Data Analysis: The data given in a Table, Graph, Bar Diagram, Pie Chart, Venn diagram or a passage is to be analyzed and the questions pertaining to the data are to be answered.

c. Coding and Decoding Problems: A code pattern of English Alphabet is given. A given word or a group of letters are to be coded and decoded based on the given code or codes.

d. Date, Time and Arrangement Problems: Calendar problems, Clock Problems, Blood Relationship, Arrivals, Departures and Schedules; Seating Arrangements, Symbol and Notation Interpretation.

21.COMMUNICATIVE ENGLISH

Name of the Item	Components
1. GRAMMAR	Articles Prepositions Tenses Pronouns Concord Question Tags
2. VOCABULARY	Synonyms Antonyms One word Substitutes Affixes Homophones Words often confused
3. ERROR ANALYSIS	Spotting Errors (Includes all the components mentioned in this syllabus)
4. USAGE	Sentence Improvement Idioms Phrasal verbs
5. READING COMPREHENSION	Main idea Factual Questions Inferential Vocabulary
6. REARRANGEMENT OF PARTS IN SENTENCES	Jumbled parts of a sentence to be rearranged (Tests understanding of relation between form and function)
7. FUNCTIONAL ENGLISH	Requesting Complaining Seeking Permission Apologising Suggesting