

Bharat Sanchar Nigam Limited

(A Govt. of India Enterprise)

Corporate Office

(Personnel-IV Section)

[Establishment Branch]

Bharat Sanchar Bhawan, New Delhi-110 001

No. 5-14/2009-Pers.IV

Dated: Nov 30, 2011.

TO,

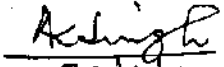
The Chief General Managers, Telecom Factories
KOLKATA / JABALPUR / MUMBAI.

Subject:- Revised Scheme and Syllabus for Limited Internal Competitive Examination (LICE) for filling up posts in the cadre of Junior Telecom Officer(TF) - Modification thereof.

In partial modification to this office letter of even no dated July 30.7. 2009, I am directed to enclose herewith a copy of revised Scheme for Limited Internal Competitive Examination (LICE) for filling up posts in the cadre of Junior Telecom Officer (TF) for favour of further necessary action at your end please. The revised scheme shall be applicable for the examination to be held in future.

It has the approval of the Competent Authority.

ENCLOSURE:- (8 Pages)


30/11/11
(A. K. Singh)

Asstt. General Manager (Pers-IV),

TF: 011-23734152 FAX: 011-23734051.

Copy to:-

1. P.S. to MOC&IT/ MOS (C &IT).
2. CMD, BSNL, New Delhi.
3. DIRECTOR
(HR)/ (CFA)/ (CM)/ (Fin.)/ (Enterprise), BSNL.
4. PGM/ GM
(Pers)/ (Estt.)/ (TF)/ (Trg.)/ (IR), BSNL.
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6. DGM
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7. ADG (PAT)/ (SNG), DoT.
8. AGM (Pers-I)/ (Pers-II)/ (Pers-III)/ (Pers-IV)/ (Pers-V), BSNL CO.
9. All Unions/Associations concerned.
10. OL section for Hindi version.
11. Intranet BSNL.
12. Spare copy.


(M S Rohilla) 20/11/11

Dy. Manager (Pers-IV)

Subject :- Scheme & Syllabus for the Limited Internal Competitive Examination (LICE) for filling up posts in the cadre of Junior Telecom Officer(TF)

1.SCHEME OF EXAMINATION :-

The Question Paper will consists of three parts as given under :

Subject	Maxi.Marks-200	Duration
Part A General English & General Studies (Objective Multiple choice Questions)	50 Marks (50 Question of one Mark each)	3 Hrs.
Part B -General Engineering (Objective Multiple Choice Questions)	50 Marks (50 Questions of one Mark each)	
Part C -Technical Paper (Specialization) (Objective Multiple Choice Questions)	100 Marks (50 Question of two marks each)	

2. The minimum qualifying marks in the examination will be 30% in each part and 37% in aggregate for OC category candidates and 23% in each part and 30% in aggregate for SC/ST category candidates . There would be negative marking and for each wrong answer 25% of the mark of that question would be deducted.

3 . SYLLABUS :

3.1 Part A General English & General Studies - 50 Marks.

Standard of the paper will be such that of CBSE Xth Standard.

3.1.1 General English-25 Marks

The question paper in Genral English shall be designed to test the candidate's understanding of English.

The pattern of question shall be broadly as follows:-

- (i) Comprehension of given passages.
- (ii) Usages and vocabulary
- (iii) Grammer

3.1.2 General Studies-25 marks.

The paper on general Studies shall include questions on the following topics:-

- (i) General Science.
- (ii) Geography of India and its natural resources.
- (iii) Current Events of National & International Importance.
- (iv) General Mental Ability Test

Questions on General Science shall cover General Appreciation and understanding of Science including matters of everyday observation and experience, as may be expected of an educated person, who has not made a special study of any scientific discipline.

Questions on the Geography of India and its natural resources may relate to Physical, Social and Economic Geography of India.

Questions in the General Mental Ability Test shall include questions on Analogies, similarities, differences, space visualization, problem solving, analysis, judgement, decision making, visual memory, discrimination, observation, relationship, concepts, arithmetical reasoning, verbal & figure classification, arithmetical number series etc.

3.2 PART B :
GENERAL ENGINEERING (Objective Multiple Choice Questions)
50 Marks.

NOTE: The standard of paper will be that of an Engineering Diploma Examination.

SECTION-A - 25 MARKS

Engineering Drawing:-

Projections and Multi view representations, sectional views, dimensioning, tolerances, Machining and Welding symbols, Production drawing, graphs and charts, computer graphics.

Hydraulic Machines:-

Flow through pipes, water pumps.

Production Engineering:-

Estimation and costing, welding technology, testing and defects in welds other methods of fabrication, assembly methods of fabrication work, testing of fabricated assembly, fundamentals of CAD/CAM, Electroplating, Galvanising.

Industrial Engineering:-

Productivity, work study, method study, principles of motion economy, material handling and plant layout, job evaluation, statistical quality control.

Machine Tools Technology:-

Metal cutting theory, lathe, turret, copying automatic lathes, boring machines, milling machines, grinding machines, unconventional machines, special purpose machines, Jigs and fixtures, machine tool drives, installation and testing of machine tools.

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Materials Technology:-

Heat treatment of steels. Ferrous Metals and alloys, non ferrous metals and alloys, non-metallic materials, plastics, powder metallurgy.

Manufacturing Process:-

Metal casting, Mechanical working, metal joining.

Metrology & Instrumentation:-

Inspection, general Measurement concepts, linear Measurement, Angular, straightness, flatness, squareness and roundness testing, surface roughness, screw thread measurement, gear measurement, limit gauges.

Regrigeration & Air conditioning:-

Maintenance of Regrigeration and Air conditioning Units.

Strength of Materials:-

Shear force and bending moment of beams.

Thermal Engineering:-

IC Engines and Air compressors.

SECTION - B - 25 MARKS

Electrical Engineering Drawing:-

Symbols and notations, domestic wiring, instrument circuits, winding diagrams, electric machine drawings, power wiring, simple electronic circuits, alternator panel diagrams, transmission and distribution.

Electronic & Electrical Measurement & Measuring Instrument:-

Electrical Measuring Instruments, Watt metres and energy metres, measurement of resistance, measurement of inductance and capacitance, Cathode Ray Oscilloscope, electronic voltmeters, audio and radio frequency measurements, A F & R F Power measurements, digital instruments.

Electrical Installation & Maintenance:-

Installation, commissioning, earthing, insulation testing and maintenance, preventive maintenance, electrical accidents and safety measures, maintenance of relays and circuit breakers.

1-Phase and 3-Phase Transformer:-

Principles of operation, equivalent circuit, voltage regulation O.C. and S.C. tests, efficiency, auto transformers.

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Power factor:-

Improvement, types of faults, short circuit current for system of protection of transformers.

Switch Gears:-

Rating of Circuit Breakers, HRC fuses, Protection of Transformers.

Industrial Electronics:

Power rectification, Controlled electrification, inverters, converters, regulated power supply, speed control, motors, microprocessors and computers.

Digital Electronics:

Fundamentals of digital electronics, combinational circuits, decoders, encoders, binary code converters, implementation of using these combinational units.

Communication Systems:-

Amplitude, frequency and phase modulation, their generation and demodulation, Noise. PCM, basic principles of SPC Exchanges and data communication, Radio communication systems.

PART C

3.3 TECHNICAL PAPER (Specialisation) - 100 Marks

NOTES:

1. The standard of paper will be that of an Engineering Diploma Examination.
2. The candidates may choose any ONE of the following Engineering Streams:-

- (a) Mechanical Engineering
- (b) Electrical Engineering.
- (c) Telecommunication Engineering.
- (d) Electronics Engineering.
- (e) Computer Science & Engineering.
- (f) Metallurgical Engineering.

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3.3.1 SYLLABUS FOR MECHANICAL ENGINEERING.

Advanced Design & Mechanical Drafting:

Projections & Multi view representation, sectional views, auxiliary views, dimensioning, tolerancing, machining & welding symbols, production drawing, pressure vessels & pipe drafting, gear drawings, reproduction & preservation of drawings, graphs & charts, computer graphics, review of designing & drafting, shaft, belt & rope drive, spur gear, welded & riveting joints, crank & lever, screw jacks, springs, journal bearings, connecting rod, drawing of tail stock of lathe.

Automobile Engg:

Auto engines, auto electrical systems, transmission system, final drive system, braking system, front axle & steering, frame & suspension, other miscellaneous items.

CAD/CAM:

Fundamentals of CAD/CAM, CAD/CAM Hardware, software of CAD/CAM system, introduction to Auto CAD, introduction to conventional numerical control, introduction to part programming through numerical control, introduction to different types of computer based numerical control system.

Fluid mechanics & Hydraulics machines :

Fundamentals of fluid flow, pressure & its measurement, basic equation of fluid flow. Flow through pipes, impact of jets, water pumps.

Fabrication Technology:

Fabrication technology, preparation, estimation & costing, welding technology, other methods of fabrication, assembly methods for fabrication work, testing of fabricated assemblies.

Industrial Engineering

Introduction, productivity, work study, method study, principles of motion economy, material handling and plant layout, micromotion study, workmanagement, job evaluation, wages & incentives, statistical quality control, control charts for variables and attributes, acceptance sampling, reliability.

Machine Tools Technology:

Introduction, metal cutting theory, lathe, Turret, copying automatic lathes & boring machine, milling machines & process, grinding machines & finishing processes, unconventional machines, special purpose machines, jigs & fixtures, machine tool, machine tool drives, installation & testing of machine tools.

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Materials Technology:

Engineering Requirement of materials, mechanical properties of materials & their testing, structure of solid materials, structural imperfections, permanent reformation, practical metallography, phase diagram & phase transformation, Iron carbon system, Heat treatment of steels, Ferrous metals & alloys, non-ferrous metals & alloys, non-metallic materials, plastics, powder metallurgy, metal preservation, selection of materials.

Manufacturing Process:

Introduction to manufacturing processes, metal casting, mechanical working, metal joining.

Metrology & Instrumentation:

Inspection, general Measurement concept, linear measurement, angular, straightness, flatness, squareness & roundness testing, surface roughness, screw thread measurement, gear measurement, limit gauges, transducers, temperature measurement, pressure & flow measurement.

Refrigeration & Air conditioning:-

Refrigeration, thermodynamics of refrigeration, basic components of vapour compression refrigeration system, properties of commonly used refrigerants, application of refrigerants; refrigeration fittings, tools, charging and leak detection; air conditioning, psychometry, air conditioning system, maintenance & repairing of refrigeration & air conditioning units.

Strength of Materials :

Simple stresses and strain, sheer force and bending moment of beams, mechanical properties and testing of materials, theory of simple bonding, torsion of surplus shafts, thin cylinders, simple mechanisms, transmission of powers, crank diagrams, flywheel, balancing, cams.

Theory of machines & design and machine elements:

Simple mechanism, velocity and acceleration of points & links, crank effort diagrams and fly wheel, friction, power transmission by belt, ropes, chain drives & gear drives, governors, cage and followers, balancing of machine parts, vibrations, introduction to machine elements, design of machine elements subjected to direct & shear loads subjected to bending & twisting & design of riveted joint, design of simple welded joints, design of threaded joints.

Thermal Engineering:

Dimensions and system of units basic concept of thermodynamics, first and 2nd law of thermo dynamics, ideal gases and gas processes, thermo dynamic cycles, two phase system, IC Engines, air compressors, heat transfer.

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Tool Engineering:

General consideration in tool design, design of cutting tools, work holding devices, design of press working tools, numerical control in machine tools, gauges & gauge design.

3.3.2 SYLLABUS FOR ELECTRICAL ENGINEERING

Electrical Engineering drawing:

Symbols and notations, domestic wiring, instrument circuits, winding diagrams, electric machine drawing, power wiring, simple electronic circuits, alternator panel diagrams, transmission & distribution.

Electronic and Electrical measurement and measuring instrument:

Classification of measuring instrument, errors and accuracies, construction operation and other details of electrical measuring instruments, watt metres & energy meters, measurement of resistance, measurement of inductance and capacitance, additional measuring instrument, magnetic measurement, Di-electric measurement, Cathode Ray oscilloscope, electronic voltmeters, audio & radio frequency measurements, A.F. & R.F. power measurements, digital instruments.

Electrical Machines:

Energy conversion principles, D.C. Generator, D.C. Motors, Transformers, 3 Phase induction motor, synchronous machines (synchronous generator and motors), single phase motors, AC Commutator motor, special purpose machines.

Industrial Electronics:

Power rectification, controlled electrification, inverters, converters, regulated power supply, speed control, motors, HF heating, resistance building, micro processors & computers.

Installation and Maintenance:

Installation, commissioning, earthing, insulation, testing and maintenance, preventive maintenance, environmental pollution prevention, trouble shooting, electrical accidents & safety measures, testing and maintenance of relays and circuit breakers, Hotline maintenance.

Instrumentation and Control:-

Measuring system, transducers, signal conditioner, indicators and recorders, measurement of physical quantity, material analysis, telemetry, process control.

Power Electronics:

The Thyristor, rating, protection and cooling of thyristor, application, driver/trigger, circuits convertors, DC Motor control, AC motor control, timers.

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Power System & Control:

Circuit diagram, economic operation of power system, load flows, HVDC/HVAC MW and MVAR, power system security and LOLP-calculations, system monitoring, transients in power systems.

Power System, Operation and Protection:

Power system, representation of power system, symmetrical components, power system, stability and reliability, control of active and reactive power, modern trends, introduction to protection, protective relaying, circuit interruption devices, protection against over voltages, protection schemes.

Utilization of electrical powers:

Electric drives, electric heating, electric welding, illumination, power factor improvement, electro-chemical process and storage batteries.

3.3.3 SYLLABUS FOR TELECOMMUNICATION ENGINEERING

Analogue Electronic Components & Applications:

Principles, characteristics & operational modes of differential amplifier, differential amplifiers, CP-AMPs & its IC configurations, block diagram, IC packages, ideal characteristics of CP-AMPs, electrical parameters.

Antenna & Microwave Techniques:

Wave propagation, Microwave devices & components, microwave measurements, transmission lines & their characteristics, antenna fundamentals & their characteristics.

Audio/Radio Engg:

Audio engineering, sound transducers, sound recording & reproduction, sound transmission, radio transmission, radio reception.

Analogue Signal Conditions:

Linear applications, inverting, non-inverting amplifiers, non-linear applications, precision rectifiers, active filters, comparators & convertors, voltage regulators, special application circuits, timers.

Digital Electronic Components & Applications:

Number system, Boolean Algebra, Logic gates, logic families, logic design, arithmetic logic unit, combinational & sequential logic circuits, memories.

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Tool Engineering:

General consideration in tool design, design of cutting tools, work holding devices, design of press working tools, numerical control in machine tools, gauges & gauge design.

3.3.2 SYLLABUS FOR ELECTRICAL ENGINEERING

Electrical Engineering drawing:

Symbols and notations, domestic wiring, instrument circuits, winding diagrams, electric machine drawing, power wiring, simple electronic circuits, alternator panel diagrams, transmission & distribution.

Electronic and Electrical measurement and measuring instrument:

Classification of measuring instrument, errors and accuracies, construction operation and other details of electrical measuring instruments, watt metres & energy meters, measurement of resistance, measurement of inductance and capacitance, additional measuring instrument, magnetic measurement, Di-electric measurement, Cathode Ray oscilloscope, electronic voltmeters, audio & radio frequency measurements, A.F. & R.F. power measurements, digital instruments.

Electrical Machines:

Energy conversion principles, D.C. Generator, D.C. Motors, Transformers, 3 Phase induction motor, synchronous machines (synchronous generator and motors), single phase motors, AC Commutator motor, special purpose machines.

Industrial Electronics:

Power rectification, controlled electrification, inverters, converters, regulated power supply, speed control, motors, HF heating, resistance building, micro processors & computers.

Installation and Maintenance:

Installation, commissioning, earthing, insulation, testing and maintenance, preventive maintenance, environmental pollution prevention, trouble shooting, electrical accidents & safety measures, testing and maintenance of relays and circuit breakers, Hotline maintenance.

Instrumentation and Control:-

Measuring system, transducers, signal conditioner, indicators and recorders, measurement of physical quantity, material analysis, telemetry, process control.

Power Electronics:

The Thyristor, rating, protection and cooling of thyristor, application, driver/trigger, circuits convertors, DC Motor control, AC motor control, timers.

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Line Communication:

Basics of communications, fundamentals of wire telephony, fundamentals of electro exchange, pulse code modulation, basic principles of SPC Exchanges, data communication.

Magnetism & Electromagnetism:

Static magnetic fields, electromagnetic field in daily life. Forces of attraction & repulsion - inverse square law, magnetic poles, electromagnetic induction:- Flux linkage & its circuits Faraday's laws of electromagnetic force, Lenz's law, self inductance, mutual inductance, Eddy current, application of electromagnetic functions.

Total internal reflection in fibre optics:-

wave nature of light, colour spectrum, photographic camera lens, zoom lens, effect of light on special material, photo electric effect, photo cell, photo diode, model of atom, quantum numbers, periodic table valency, crystal, primary & secondary cells, electrode potential.

Magnetic Materials:

Permeability, factors affecting the properties of magnetic materials, classification of magnetic materials such as hard & soft, di, para, ferro & ferri, ferrite magnetic materials.

Micro processors & its application :

Architecture & programming of 8086/8088, Microprocessor based data acquisition, memory address & DMA controllers, arithmetic co-processors, other micro processors, micro processor applications.

Semi Conducting Materials:

Difference among conductor, insulator & semi conductors, role of semiconductors, special materials, flux, solder, soft & hard solder, materials used for chassis making.

3.3.4 SYLLABUS FOR ELECTRONICS ENGINEERING

Analogue Electronic Components & Applications:

Principles, characteristics & operational modes of differential amplifier, differential amplifiers, CP-AMPs & its IC configurations, block diagram, IC packages, ideal characteristics of CP-AMPs, electrical parameters.

Analogue Signal Conditions:

Linear applications, inverting, non-inverting amplifiers, non-linear applications, precision rectifiers, active filters, comparators & convertors, voltage regulators, special application circuits, timers.

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- 10 -

Antenna & Microwave Techniques:

Wave propagation, Microwave devices & components, microwave measurements, transmission lines & their characteristics, antenna fundamentals & their characteristics.

Audio/Radio Engg:

Audio engineering, sound transducers, sound recording & reproduction, sound transmission, radio transmission, radio reception.

Electronics Engineering Materials:-

Conducting Materials:

Cu, Al, steel, nichrome's characteristics such as electrical, thermal, chemical, physical, mechanical and application of conducting materials & insulated conductors.

Insulating Materials:

Classification of insulating materials on chemical basis, solid & liquid insulating materials & properties, classification on the basis of temperature, porcelain, ceramic, PVC glass, bakelite, mica, paper.

Magnetic Materials:

Permeability, factors affecting the properties of magnetic materials, classification of magnetic materials such as hard & soft, di, para, ferro & ferri, ferrite magnetic materials.

Semi conducting materials:

Difference among conductor, insulator & semi conductors, role of semiconductors, special materials, flux, solder, soft & hard solder, materials used for chassis making.

Digital Electronic Components & Applications:

Number system, Boolean Algebra, Logic gates, logic families, logic design, arithmetic logic unit, combinational & sequential logic circuits, memories.

Total internal reflection in fibre optics:-

Wave nature of light, colour spectrum, photographic camera lens, zoom lens, effect of light on special material, photo electric effect, photo cell, photo diode, model of atom, quantum numbers, periodic table valency, crystal, primary & secondary cells, electrode potential.

Electronics Measurement Technology & Application:

Measuring systems, measurement of circuit components, Instrument transformers, Cathode ray oscilloscope, transducers, recorders.

Line Communication:

Basics of communications, fundamentals of wire telephony, fundamentals of electro exchange, pulse code modulation, basic principles of SPC Exchanges, data communication.

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Magnetism & Electromagnetism:

Static magnetic fields, electromagnetic field in daily life. Forces of attraction & repulsion – inverse square law, magnetic poles, electromagnetic induction:- Flux linkage & its circuits Faraday's laws of electromagnetic force, Lenz's law, self inductance, mutual inductance, Eddy current, application of electromagnetic functions.

Micro processors & its application :

Architecture & programming of 8086/8088; Microprocessor based data acquisition, direct memory address & DMA controllers, arithmetic co-processors, other micro processors, micro processor applications.

3.3.5 SYLLABUS FOR COMPUTER SCIENCE & ENGINEERING

Computer Architecture:

Computer architecture, basic computer organization and design programming, the basic computer, central processing units, input & output organization, memory organization, pipeline and vector processing.

Computer Networks:

Introduction to computer network, LAN, MAN, WAN, network essentials, Internet addresses, ARP, RARP, Internet protocols, subnet, supernet address extension, user data, gram protocol, transmission control protocol, routines, internet multi testing, socket interface, domain name systems, applications.

Data Structure and Algorithms:

Basic concepts of data representation, introduction to algorithms design and data structure, Arrays, stacks and queues, linked lists, storage allocation and garbage collection, symbol tables, searching and sorting, storing & their futures, graphs.

Database Management Systems:

Database, Data models, rational alzebra and normalization, statistical quality level, distributed and object data basis.

Digital Electronics:

Fundamentals of digital electronics, combinational circuits, decoders, encoders, binary code converters, implementation of using these combinational units.

Hardware Installation and Maintenance:

Introduction and safety measures, bus architecture and ports, mother board, CPU and monitor, C MDS set up, peripheral networking devices, troubleshooting and maintenance.

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Management Information Technology:

Enterprise resource planning, supply chain management, customer relationship management, data warehousing and mining, knowledge management, Internet technology (blue tooth), Legal & professional aspects of computing.

Micro processor and interfaces:

Introduction to microprocessors and its applications, microprocessor architecture and micro computer systems, 8085 microprocessor architecture and micro computer, memory interfacing, programming to 8085, architecture and programming 8086/8088 peripherals and interfacing, arithmetic coprocessors, other microprocessor.

Advanced Computer Architecture:

Classification of parallel computers, pipelined vector processors, scaler & super scaler processors, SIMD or Array processors systems, MIMD and Multi processors systems, RAM Model of parallel computing, parallel algorithm for multi processor systems, VLSI computations.

Advanced Web Technology:

Overview of HTML, active server page, A&P components, accessing data basis with A&P and ADO, J Script.

Artificial Intelligence & Expert Systems:

General issues and overview of AI problem solving and control strategies, Heuristics Search techniques, Game playing, knowledge representation, natural language processing, expert system.

Combinational Circuits:

Flip-flops, level clocking, registers, Buffer, serial parallel & shift, counters - synchronous, asynchronous, wave shaping circuits and logic families, multivibrators, convertors, sample and hold circuits, introduction to logic families and comparisons, classification and characteristics of memories, memory organization, memory mapping.

Software Engineering:

Basics of software engineering, software project planning, system engineering, analysis concepts, principle and modeling, object to oriented concept, principle and analysis, design concept, principle and methods, object oriented design, Software testing, software quality, project management.

Visual and windows APD programming:

Basic building blocks, testing and debugging, DLE, graphics and menu, accessing and controlling data, API.

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3.6 SYLLABUS FOR METALLURGICAL ENGINEERING

Alloy Formation & Phase Diagrams:

Solidification of metals & alloys, grains & crystals alloy formation, solid solutions, intermediate phases in alloys systems, Equilibrium diagrams.

Bearing Metals:

Effect of alloying elements, Tin-base alloys of Pb, Sb, & Sn, Microstructure of tin-base alloys.

Cast Iron:

Chilled castings, centrifugal castings, spheroidal graphite or nodular cast iron, alloy cast irons.

Ceramic Materials:

Atomic structure of ceramic materials, crystal structure of ceramics, ceramic fabrication processes, spray coating ceramic materials.

Copper & Zinc Alloys:

Properties of copper, uses of copper, effect of impurities of copper, zinc, tin, lead & its alloys, physical properties & its uses, solder alloys.

Corrosion & its Control:

General, chemical corrosion, electromechanical corrosion, galvanic action, corrosive agents, prevention of corrosion.

Extraction of Al, Cu, Zn, Sn, Pb:

Ores of Al, Cu, Zn, Sn, Pb & extraction of Cu, Al, Zn, Sn, Pb from its ores, roasting before smelting, distillation, reverberatory & blast furnaces, extraction, electrodes, purification, hydrometallurgy & electrolysis, electrolytic refining.

Foundry:

Cupola & its operation, recent trends in cupola practice; moulding sands.

Heat Treatment of Steel:

Isothermal decomposition of austenite, pearlite, bainite, martensite, annealing, hardening & tempering of steel, quenching cracks, hypoeutectid steels, sub-zero treatment.

Light Metals:

Aluminium & its alloys, titanium & its alloys, magnesium & its alloys.

Manufacture of Pig Iron :

Blast furnace plant & charging appliances, stores, gas cleaning plant, power & pumping plant, lining of furnace, functions of blast furnace, ladle, electric smelting of P.I.

Mechanical Properties & Testing of Metals:

Tensile strength & related properties, stress, strain, limit of proportionality & elastic limit, yield point, plasticity, plastic deformation and permanent set, percentage elongation & reduction of area, Hardness – Brinell test, vicker's Diamond pyramid method, Rockwell test, Shore or Rebound hardness test, impact test, creep, fatigue, non-destructive test.

Mechanical Treatment of Steel:

Benefits of mechanical working, heating for hot working, methods of mechanical treatment, rolling, extrusion, wire drawing.

Organic Materials:

Hydrocarbons, other organic compounds, isomers, polymer polymerization mechanisms, elastomers.

Physical properties of Metals & Alloys:

The periodic table, properties of metals, electrical conductivity of metals & alloys, magnetism, magnetic properties of alloys.

Plastic Deformation & Annealing of Metals:

Crystalline structure of metals, elastic deformation in metals, plastic deformation, hardening and strengthening affect of grain boundaries, importance of grain size, fibre structure & directional properties, recovery, recrystallization and grain growth, importance of finishing temperature.

Powder Metallurgy:

Advantages, limitation, manufacturing process, powder production, sintering products.

Principles & processes of extractive Metallurgy:

Metallurgy, occurrence of metals, minerals & ores, ore-dressing, floatation – differential floatation, methods of extraction, unit processes of pyrometallurgy, smelting, calcinations, roasting, Fire-refining, distillation, converting, fluxes, classifications, chemical composition & uses of slags.

Pyrometry:

Types of pyrometers – resistance, radiation & optical pyrometers, industrial application of pyrometers.

Raw Materials for Iron & Steel Industry:

Iron ore & its varieties, impurities of iron-ores & their effects, fuel, coal injection of fuel in blast furnaces, fluxes.

Refractories:

Classification of refractories, acid refractories – silica bricks, fireclays, basic refractories, neutral, refractories, insulating refractories, applications of refractories in steel plant, selection of refractories.

Selection of Materials:

Classification of engineering materials.

Structure of Metals & Alloys:

The atom, packing factor, defects or imperfections in crystals, preparation of specimen, Etching metallurgical microscope.

Structure of Iron-Carbon Alloys:

Pure Iron-Carbon alloys, structure of cast iron & steels, allotropic forms of iron, decomposition of austenite, crystalline structure of steel, grain refinement on heating, overheated & burnt steels.

Steels:

Plain carbon steels, alloy steels, Nickel-chromium steels, manganese steels, tungsten steels, high speed steels, nickel & its alloys, low alloy high strength steels, heat resistant steels.

Steel Making:

Methods of making steels - Acid & basic Bessemer process, acid open hearth process, manufacture of steel in electric furnaces, chemical reactions of electric process, steel ingots & their defects.

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