RRB JE, DMS, CMA & Other Posts Syllabus Details

RRB JE, DMS, CMA & Other Posts Syllabus Details

RRB JE, DMS, CMA & Other Posts Syllabus Details: Here providing syllabus for Railway Recruitment Board (RRB) Junior Engineer (JE), Depot Material Superintendent (DMS), Chemical & Metallurgical Assistant (CMA), Chemical Supervisor /Research and Metallurgical Supervisor /Research Posts.

Syllabus: Candidates should apply only through online mode through the official websites of any RRBs. Candidates can apply to only one RRB and only one common online application (in order of preference for any or all the notified posts). The selection of RRB once exercised shall be final. Application to more than one RRB by a candidate will lead to rejection of all the applications.

The recruitment process shall comprise of the following stages:
(i) 1st Stage Computer Based Test (CBT-I)
(ii) 2nd Stage Computer Based Test (CBT-II)
(iii) Document Verification (DV)
(iv) Medical Examination (ME)

Syllabus for 1st Stage CBT (Common for all notified posts of this CEN):

The 1ststage CBT is of screening nature and the standard of questions for the CBT will be generally in conformity with the educational standards and/or minimum technical qualifications prescribed for the posts. The normalized score of 1st stage exam shall be used only for short listing of candidates for 2nd stage exam as per their merit. Candidates who are shortlisted for 2nd stage CBT availing the reservation benefits of a community, PwBD and ExSM shall continue to be considered only against that community for all subsequent stages of recruitment process. The Questions will be of objective type with multiple choices and are likely to include questions pertaining to:

a. Mathematics:

Number systems, BODMAS, Decimals, Fractions, LCM and HCF, Ratio and Proportion, Percentages, Mensuration,

Time and Work, Time and Distance, Simple and Compound Interest, Profit and Loss, Algebra, Geometry, Trigonometry, Elementary Statistics, Square Root, Age Calculations, Calendar & Clock, Pipes & Cistern.

b. General Intelligence and Reasoning:

Analogies, Alphabetical and Number Series, Coding and Decoding, Mathematical operations, Relationships,

Syllogism, Jumbling, Venn Diagram, Data Interpretation and Sufficiency, Conclusions and Decision Making, Similarities and Differences, Analytical reasoning, Classification, Directions, Statement – Arguments and Assumptions etc.

c. General Awareness:

Knowledge of Current affairs, Indian geography, culture and history of India including freedom struggle, Indian Polity and constitution, Indian Economy, Environmental issues concerning India and the World, Sports, General Scientific and technological developments etc.

d. General Science:

Physics, Chemistry and Life Sciences (up to 10th Standard CBSE syllabus). The section wise Number of questions
and marks are as below:

Subjects	**No. of Questions**	**Marks for each Section**
	CBT-I	CBT-I
Mathematics	30	30

General Intelligence & Reasoning	25	25
General Awareness	15	15
General Science	30	30
Total	**100**	**100**
Time in Minutes	90	

2nd Stage CBT:

Short listing of Candidates for the 2nd Stage CBT exam shall be based on the normalized marks obtained by them in the 1st Stage CBT Exam. Total number of candidatesto be shortlisted for 2nd Stage shall be 15 timesthe community
wise total vacancy of Posts notified against the RRB as per their merit in 1st Stage CBT. However, Railways reserve
the right to increase/decrease this limit in total or for any specific category(s) as required to ensure availability of adequate candidates for allthe notified posts.

Syllabus: The Questions will be of objective type with multiple choices and are likely to include questions

pertaining to General Awareness, Physics and Chemistry, Basics of Computers and Applications, Basics of Environment and Pollution Control and Technical abilities for the post. The syllabus for General Awareness, Physics and Chemistry, Basics of Computers and Applications, Basics of Environment and Pollution Control is common for all notified posts under this CEN as detailed below:

a) General Awareness:

Knowledge of Current affairs, Indian geography, culture and history of India including freedom struggle, Indian Polity and Constitution, Indian Economy, Environmental issues concerning India and the World, Sports, General Scientific and Technological Developments etc.

b) Physics and Chemistry: Up to 10th standard CBSE syllabus.

c) Basics of Computers and Applications:

Architecture of Computers; input and Output devices; Storage devices, Networking, Operating System like Windows, Unix, Linux; MS Office; Various data representation; Internet and Email; Websites & Web Browsers; Computer Virus.

d) Basics of Environment and Pollution Control:

Basics of Environment; Adverse effect of environmental pollution and control strategies; Air, water and Noise

pollution, their effect and control; Waste Management, Global warming; Acid rain; Ozone depletion.

e) Technical Abilities:

The educational qualifications mentioned against each post shown in Annexure-A, have been grouped into different exam groups as below. Questions on the Technical abilities will be framed in the syllabus defined for various Exam Groups given at Annexure-VII-A, B, C, D, E & F.

The section wise Number of questions and marks are as below:

Subjects	**No. of Questions**	**Marks for each Section**
	CBT-II	CBT-II
General Awareness	15	15
Physics & Chemistry	15	15
Basics of Computers and Applications	10	10
Basics of Environment and Pollution Control	10	10
Technical Abilities	100	100

Total	**150**	**150**
Time in Minutes	120	

Syllabus for Civil & Allied Engineering Exam Group–JE

1. Engineering Mechanics- Force (resolution of force, moment of force, force system, composition of forces), Equilibrium, Friction, Centroid and Center of gravity, Simple machines.
2. Building Construction- Building components (substructure, superstructure), type of structure (load bearing, framed and composite structures).
3. Building materials- Masonry materials (stones, bricks, and mortars), Timber and miscellaneous materials (glass, plastic, fiber, aluminium steel, galvanized iron, bitumen, PVC, CPVC, and PPF).
4. Construction of substructure- job layout, earthwork, foundation (types, dewatering, coffer dams, bearing capacity).
5. Construction of superstructure- stone masonry, brick masonry, Hollow concrete block masonry, composite masonry, cavity wall, doors and windows, vertical communication (stairs, lifts, escalators), scaffolding and

shoring.
6. Building finishes- Floors (finishes, process of laying), walls (plastering, pointing, painting) and roofs (roofing materials including RCC).
7. Building maintenance- Cracks (causes, type, repairs-grouting, guniting, epoxy etc.), settlement (causes and remedial measures), and re-baring techniques.
8.Building drawing- Conventions (type of lines, symbols), planning of building (principles of planning for residential and public buildings, rules and byelaws), drawings (plan, elevation, section, site plan, location plan, foundation plan, working drawing), perspective drawing.
9. Concrete Technology- Properties of various types/grades of cement, properties of coarse and fine aggregates, properties of concrete (water cement ratio, properties of fresh and hardened concrete), Concrete mix design, testing of concrete, quality control of concrete (batching, formwork, transportation, placing, compaction, curing, waterproofing), extreme weather concreting and chemical admixtures, properties of special concrete (ready mix, RCC, pre-stressed, fiber reinforced, precast, high performance).
10. Surveying- Types of survey, chain and cross staff survey (principle, ranging, triangulation, chaining, errors,

finding area), compass survey (principle, bearing of line, prismatic compass, traversing, local attraction, calculation of bearings, angles and local attraction) leveling (dumpy level, recording in level book, temporary adjustment, methods of reduction of levels, classification of leveling, tilting level, auto level, sources of errors, precautions and difficulties in leveling), contouring (contour interval, characteristics, method of locating, interpolation, establishing grade contours, uses of contour maps), area and volume measurements, plane table survey (principles, setting, method), theodolite survey (components, adjustments, measurements, traversing), Tacheometric survey, curves (types, setting out), advanced survey equipment, aerial survey and remote sensing.

11. Computer Aided Design- CAD Software (AutoCAD, Auto Civil, 3D Max etc.), CAD commands, generation of plan, elevation, section, site plan, area statement, 3D view.

12. Geo Technical Engineering- Application of Geo Technical Engineering in design of foundation, pavement, earth retaining structures, earthen dams etc., physical properties of soil, permeability of soil and seepage analysis, shear strength of soil, bearing capacity of soil, compaction and stabilization of soil, site investigation and

sub soil exploration.
13. Hydraulics- properties of fluid, hydrostatic pressure, measurement of liquid pressure in pipes, fundamentals of fluid flow, flow of liquid through pipes, flow through open channel, flow measuring devices, hydraulic machines.
14. Irrigation Engineering- Hydrology, investigation and reservoir planning, percolation tanks, diversion head works.
15. Mechanics of Structures- Stress and strain, shear force and bending moment, moment of inertia, stresses in beams, analysis of trusses, strain energy.
16. Theory of structures- Direct and bending stresses, slope and deflection, fixed beam, continuous beam, moment distribution method, columns.
17. Design of Concrete Structures- Working Stress method, Limit State method, analysis and design of singly reinforced and doubly reinforced sections, shear, bond and development length, analysis and design of T Beam, slab, axially loaded column and footings.
18. Design of Steel Structures- Types of sections, grades of steel, strength characteristics, IS Code, Connections, Design of tension and compression members, steel roof truss, beams, column bases.

19. Transportation Engineering- Railway Engineering (alignment and gauges, permanent way, railway track geometrics, branching of tracks, stations and yards, track maintenance), Bridge engineering (site selection, investigation, component parts of bridge, permanent and temporary bridges, inspection and maintenance), Tunnel engineering (classification, shape and sizes, tunnel investigation and surveying, method of tunneling in various strata, precautions, equipment, explosives, lining and ventilation).
20.Highway Engineering- Road Engineering, investigation for road project, geometric design of highways, construction of road pavements and materials, traffic engineering, hill roads, drainage of roads, maintenance and repair of roads.
21. Environmental Engineering- Environmental pollution and control, public water supply, domestic sewage, solid waste management, environmental sanitation, and plumbing.
22. Advanced Construction Techniques and Equipment- Fibers and plastics, artificial timber, advanced concreting methods (under water concreting, ready mix concrete, tremix concreting, special concretes), formwork, prefabricated construction, soil reinforcing techniques,

hoisting and conveying equipment, earth moving machinery (exaction and compaction equipment), concrete mixers, stone crushers, pile driving equipment, working of hot mix bitumen plant, bitumen paver, floor polishing machines.
23. Estimating and Costing- Types of estimates (approximate, detailed), mode of measurements and rate analysis.
24. Contracts and Accounts- Types of engineering contracts, Tender and tender documents, payment, specifications

Government jobs

Syllabus for Electrical & Allied Engineering Exam Group– JE

1. Basic concepts: Concepts of resistance, inductance, capacitance, and various factors affecting them. Concepts of current, voltage, power, energy and their units.
2. Circuit law: Kirchhoff‘s law, Simple Circuit solution using network theorems.
3.Magnetic Circuit: Concepts of flux, mmf, reluctance, Different kinds of magnetic materials, Magnetic calculations for conductors of different configuration e.g. straight, circular, solenoidal, etc. Electromagnetic

induction, self and mutual induction.
4.AC Fundamentals: Instantaneous, peak, R.M.S. and average values of alternating waves, Representation of sinusoidal wave form, simple series and parallel AC Circuits consisting of R.L. and C, Resonance, Tank Circuit. Poly Phase system – star and delta connection, 3 phase power, DC and sinusoidal response of R-Land R-C circuit.
5. Measurement and measuring instruments: Measurement of power (1 phase and 3 phase, both active and reactive) and energy, 2 wattmeter method of 3 phase power measurement. Measurement of frequency and phase angle. Ammeter and voltmeter (both moving oil and moving iron type), extension of range wattmeter, Multimeters, Megger, Energy meter AC Bridges. Use of CRO, Signal Generator, CT, PT and their uses. Earth Fault detection.
6. Electrical Machines: (a) D.C. Machine – Construction, Basic Principles of D.C. motors and generators, their characteristics, speed control and starting of D.C. Motors. Method of braking motor, Losses and efficiency of D.C. Machines. (b) 1 phase and 3 phase transformers – Construction, Principles of operation, equivalent circuit, voltage regulation, O.C. and S.C. Tests, Losses and

efficiency. Effect of voltage, frequency and wave form on losses. Parallel operation of 1 phase /3 phase transformers. Auto transformers. (c) 3 phase induction motors, rotating magnetic field, principle of operation, equivalent circuit, torque-speed characteristics, starting and speed control of 3 phase induction motors. Methods of braking, effect of voltage and frequency variation on torque speed characteristics, Fractional Kilowatt Motors and Single Phase Induction Motors: Characteristics and applications.

7. Synchronous Machines: Generation of 3-phase e.m.f. armature reaction, voltage regulation, parallel operation of two alternators, synchronizing, control of active and reactive power. Starting and applications of synchronous motors.

8. Generation, Transmission and Distribution: Different types of power stations, Load factor, diversity factor, demand factor, cost of generation, inter-connection of power stations. Power factor improvement, various types of tariffs, types of faults, short circuit current for symmetrical faults. Switchgears and Protection: Rating of circuit breakers, Principles of arc extinction by oil and air, H.R.C. Fuses, Protection against earth leakage /over current, etc. Buchholz relay, Merz-Price system of

protection of generators & transformers, protection of feeders and bus bars. Lightning arresters, various transmission and distribution system, comparison of conductor materials, efficiency of different system. Cable – Different type of cables, cable rating and derating factor.
9. Estimation and costing: Estimation of lighting scheme, electric installation of machines and relevant IE rules. Earthing practices and IE Rules.
10. Utilization of Electrical Energy: Illumination, Electric heating, Electric welding, Electroplating, Electric drives and motors.
11. Basic Electronics: Working of various electronic devices e.g. P N Junction diodes, Transistors (NPN and PNP type), BJT and JFET. Simple circuits using these devices.

Syllabus for Electronics & Allied Engineering Exam Group– JE

1. Electronic Components & Materials: Conductors, Semi conductor & Insulators; Magnetic materials; Jointing & Cleaning materials for U/G copper cable & OFC; Cells and Batteries (chargeable and non chargeable); Relays, Switches, MCB & Connectors.
2. Electronic Devices and circuits: PN Junction diodes,

thyristor; Diode and triode circuits; Junction Transistors; Amplifiers; Oscillator; Multivibrator, counters; Rectifiers; Inverter and UPS.

3. Digital Electronics: Number System & Binary codes; Boolean Algebra & Logic gates; Combinational & Sequential logic circuits; A/D & D/A converter, counters; Memories

4. Linear Integrated Circuit: Introduction to operational Amplifier; Linear applications; Non Linear applications; Voltage regulators; Timers; Phase lock loop.

5. Microprocessor and Microcontroller: Introduction to microprocessor, 8085 microprocessor working; Assembly Language programming; Peripherals & other microprocessors; Microcontrollers

6. Electronic Measurements: Measuring systems; Basic principles of measurement; Range Extension methods; Cathode ray oscilloscope, LCD, LED panel; Transducers

7. Communication Engineering: Introduction to communication; Modulation techniques; Multiplexing Techniques; Wave Propagation, Transmission line characteristics, OFC; Fundamentals of Public Address systems, Electronic exchange, Radar, Cellular and Satellite Communication.

8. Data communication and Network: Introduction to data

communication; Hardware and interface; Introduction to Networks and Networking devices; Local Area Network and Wide area network; Internet working.
9. Computer Programming: Programming concepts; Fundamentals of 'C' and C ++; Operators in 'C' and C ++; Control Statements; Functions, Array String & Pointers, File Structure; Data Structure and DBMS
10. Basic Electrical Engg.: DC Circuits; AC fundamentals; Magnetic, Thermal and Chemical effects of Electric current; Earthing - Installation, Maintenance, Testing

Syllabus for Mechanical & Allied Engineering Exam Group– JE

1. Engineering Mechanics: Resolution of forces, Equilibrium and Equilibrant, parallelogram law of forces, triangle law of forces, polygon law of forces and Lami's theorem, couple and moment of a couple, condition for equilibrium of rigid body subjected to number of coplanar non-concurrent forces, definition of static friction, dynamic friction, derivation of limiting angle of friction and angle of repose, resolution of forces considering friction when a body moves on horizontal plane and inclined plane, calculation of moment of inertia and

radius of gyration of : (a) I-Section (b) channel section (c) T-Section (d) L-Section (Equal & unequal lengths) (e) Z-Section (f) Built up sections (simple cases only), Newton's laws of motion (without derivation), motion of projectile, D'Alembert's principle, definition law of conservation of energy, law of conservation of momentum.

2. Material Science: Mechanical properties of engineering materials – tensile strength, compressive strength, ductility, malleability,
hardness, toughness, brittleness, impact strength, fatigue, creep resistance. Classification of steels, mild steel and alloy steels.
Importance of heat treatment. Heat treatment processes – annealing, normalizing, hardening, tempering, carburizing, nitriding and cyaniding.

3. Strength of Materials: Stress, strain, stress strain diagram, factor of safety, thermal stresses, strain energy, proof resilience and
modules of resilience. Shear force and bending moment diagram – cant leaver beam, simply supported beam, continuous beam, fixed beam. Torsion in shafts and springs, thin cylinder shells.

4. Machining: Working principle of lathe. Types of lathes

– Engine lathe – construction details and specifications. Nomenclature of single point cutting tool, geometry, tool signature, functions of tool angles. General and special operations – (Turning, facing, taper turning thread cutting, knurling, forming, drilling, boring, reaming, key way cutting), cutting fluids, coolants and lubricants. Introduction to shaper, slotter, plainer, broaching, milling and manufacture of gears, heat treatment process applied to gears.

5. Welding – Introduction, classification of welding processes, advantages and limitations of welding, principles of arc welding, arc welding equipment, choice of electrodes for different metals, principle of gas (oxy-acetylene) welding, equipment of gas welding, welding procedures (arc & gas), soldering and brazing techniques, types and applications of solders and fluxes, various flame cutting processes, advantages and limitations of flame cutting, defects in welding, testing and inspection modern welding methods, (submerged, CO2, atomic – hydrogen, ultrasonic welding), brief description of MIG & TIG welding.

6. Grinding & Finishing Process: Principles of metal removal by grinding, abrasives, natural and artificial, bonds and binding processes, vitrified, silicate, shellac

rubber, grinding machines, classification: cylindrical, surface, tool & cutter grinding machine, construction details, relative merits, principles of centreless grinding, advantages & limitations of centreless grinding work, holding devices, wheel maintenance, balancing of wheels, coolants used, finishing by grinding, honing, lapping, super finishing, electroplating, basic principles – plating metals, applications, hot dipping, galvanizing tin coating, parkerising, anodizing, metal spraying, wire process, powder process and applications, organic coatings, oil base paint, lacquer base enamels, bituminous paints, rubber base coating.

7. Metrology: Linear measurement – Slip gauges and dial indicators, angle measurements, bevel protractor, sine bar, angle slip gauges, comparators (a) mechanical (b) electrical (c) optical (d) pneumatic. Measurement of surface roughness; methods of measurements by comparison, tracer instruments and by interferometry, collimators, measuring microscope, interferometer, inspection of machine parts using the concepts of shadow projection and profile projection.

8. Fluid Mechanics & Hydraulic Machinery: Properties of fluid, density, specific weight, specific gravity, viscosity, surface tension, compressibility capillarity, Pascal's law,

measurement of pressures, concept of buoyancy. Concept of Reynold's number, pressure, potential and kinetic energy of liquids, total energy, laws of conservation, mass, energy and momentum, velocity of liquids and discharge, Bernoulli's equation and assumptions, venturi meters, pitot-tube, current meters. Working principle & constructional details of centrifugal pump, efficiencies – manometric efficiency, volumetric efficiency, mechanical efficiency and overall efficiency, cavitation and its effect, working principle of jet & submersible pumps with line diagrams.

9. Industrial Management: Job analysis, motivation, different theories, satisfaction, performance reward systems, production, planning and control, relation with other departments, routing, scheduling, dispatching, PERT and CPM, simple problems. Materials in industry, inventory control model, ABC Analysis, Safety stock, re-order, level, economic ordering quantity, break even analysis, stores layout, stores equipment, stores records, purchasing procedures, purchase records, Bin card, Cardex, Material handling, Manual lifting, hoist, cranes, conveyors, trucks, fork trucks.

10. Thermal Engineering: Laws of thermo dynamics, conversion of heat into work vice versa , laws of perfect

gases, thermo dynamic processes – isochoric, isobaric, isothermal hyperbolic, isentropic, polytrophic and throttling, modes of heat transfer, thermal conductivity, convective heat transfer coefficient, Stefan Boltzman law by radiation and overall heat transfer coefficient. Air standards cycles – Carnot cycle, Otto cycle, Diesel cycle, construction and working of internal combustion engines, comparison of diesel engine and petrol engine. Systems of internal combustion engine, performance of internal combustion engines. Air compressors their cycles refrigeration cycles, principle of a refrigeration plant.

Government jobs

Syllabus for CMA Exam Group

1. Measurements, Units and Dimensions, Types of errors in measurements, Significance of accuracy in measurement.
2. Light: Basic principles of light - reflection, refraction, laws of reflection, total internal reflection, interference, diffraction and polarization. Formula for magnification of microscope, telescope. Electro Magnetic spectra.
3. Heat: Heat as energy- sources of heat, Transmission of heat, Expansion of solids, liquids and gases. Temperature (based on thermal equilibrium), Different Scales of

Temperature. Calorimetry, Applications of Specific heat, Latent heat. Anomalous expansion of water and its significance in nature. Combustion, Calorific value, specific heat of gases.

4. Sound: Sources of sound. Propagation of sound. Velocity of sound in different media / substances. Characteristics of sound. Reflection of sound, echo, Resonance, Sonar and Doppler effect.

5. Mechanics: Scalars and Vectors. All types of motion. Friction. Newton's laws of motion. Momentum. Equations of motion (under gravity and freely falling), projectile. Range. Laws of Floatation. Work, Power and Energy. Conservation of energy. Center of mass. Centre of gravity. Stability and Equilibrium. Universal law of Gravitation. Relation between 'g' and 'G'. Circular motion, Kepler's Laws. Elasticity and Hooke's Law.

6. Magnetism: Magnetic field, Uniform and non uniform magnetic fields. Magnetic induction. Magnetic lines of force. Magnetic pole strength, Magnetic moment. Inverse square law of magnetism. Magnetic properties of materials and their classification.

7. Electricity & Electro Magnetism: Electric charge, field, electric intensity, electric potential, potential difference. Simple Electric Circuits. Conductors, Non conductors /

Insulators, Coulomb's inverse square law. Primary and secondary Cells. Ohm's Law - its limitations. Resistances in series and parallel, Emf of a circuit; Specific resistance. Kirchhoff's laws. Relation between electric potential and Electric energy, electric Power (wattage). Heating effect of electric current, and Joule's law. Ampere's law, circular loop and Solenoid. Magnetic force on moving charged particle and long straight conductors. Fleming's left hand rule, Electric motor. Electromagnetic induction – Faraday's law Electromagnetic flux. Lentz law, Generators and Alternating Currents. Inductance – self, mutual inductance and principles of transformer.

8. Modern Physics: Discharge of Electricity through gases, Cathode rays, Anode rays and their properties; X-rays; Atomic models: JJ Thomson, Rutherford and Bohr's models. Atomic nucleus and its structure. Atomic models: Mass defect; Radio Activity- Discovery, properties of alpha, beta, and gamma radiations. Applications of alpha, beta, and gamma radiations, alpha, beta decays, Half life period, Isotopes, Isobars, and Isotones. Artificial radioactivity; radio isotopes and their uses in different fields; radioactive series; Chain and controlled nuclear reactions; Fission and fusion of nuclei - atomic bomb and hydrogen bomb.

9. Electronics and Communications: Semi conductors, diode, p-n junction characteristics. Transistor – pnp & npn characteristics and uses. Zener Diode characteristics. Simple electronic circuits, Logic gates – applications, modulation and demodulation.
10. Matter: States of matter. Elements, Compounds and Mixtures. Methods of separation of mixtures. Chromatography. Behavior of gases; measurable properties of gases; gas laws. Mole concept. Dalton, Avogadro, Berzelius laws.
11. Chemical Reactions: Physical and chemical changes. Types of Chemical reactions; Physical and Chemical properties of various compounds. Chemical calculations. NaOH, Bleaching powder, baking soda, washing soda, and their uses, Plaster of Paris.
12. Acids and Bases, Salts: Strength and uses of Acids & Bases. Neutralization. Nature and uses of different Salts. Water of crystallization. Complex, Neutral and double salts. Oxidation and Reduction, Rancidity. Identification of Acids, Bases– Indicators: Natural, Chemical. PH Scale - Role of PH in daily life-agriculture, medicine. Classification of salts based on affinity to water Examples of Acidic, Basic, Mixed, Complex, Neutral and double salts. Solutions - Types of solutions; solubility, ionization,

Concentration; Oxidation number concept. Balancing of Redox reactions, Calculation of Concentrations. Stoichiometry.

13. Atomic Structure: Electromagnetic spectrum, Atomic spectrum, Characteristics of electron, proton and neutron, Rutherford's model of an atom, nature of electromagnetic radiation, Plank's quantum mechanics, explanation of photo electric effect, features of atomic spectra, characteristics of hydrogen spectrum, Bohr's theory of structure of atom, Bohr's explanation of spectral lines, failure of Bohr's theory, wave particle nature of electrons, de Broglie's hypothesis, Heisenberg's uncertainty principle, important features of the Quantum mechanical model of an atom, Quantum numbers, concept of orbitals, define an atomic orbital in terms of quantum numbers-shapes of s, p and d orbitals, n l x rule, Energies of electronic energy levels (n+l) rule state Auffbau principle, Pauli's exclusive principle and Hund's rule of maximum multiplicity, electronic configuration of atom, explanation of stability of half filled and completely filled orbital.

14. Periodic Classification of Elements: Characteristics of elements in groups and periods. Signification of atomic number and electronic configuration as the basis per periodic classification. Classification of elements into s-

block, p-block, d-block, f-block and their main characteristics. Periodic trends in physical and chemical properties of elements. Study of different Groups of periodic table.

15. Chemical Bonding: Ionic and Covalent bonds: Introduction of chemical bonding. Electronic Configuration of Noble gases. sigma, pi bond with examples. Shapes of molecules bond lengths and bond angles in molecules. Hybridization and explanation of H_2O, BF_3, CH_4, NH_3 etc. molecules. Hydrogen bonding and types of H bonds.

16. Carbon and its Compounds: Need to study of carbon compounds separately. Classification of Organic compounds Hydro carbons - Alkanes, alkenes, alkynes aromatic and aliphatic compounds with examples. Bonding in Carbon including Hybridization. Allotropes of Carbon. Versatile nature of carbon. Tetravalency, Chains, branches and rings. Catenation, Isomerism. Saturated and Unsaturated carbon compounds. Bonding of carbon with other elements. Functional groups in carbon compounds. Homologous series. Chemical properties of carbon compounds Combustion and Oxidation. Addition reactions. Substitution reaction. Important carbon compounds. Nomenclature organic compounds.

Carbohydrates and their classification. Proteins-examples, Oils and fats examples Polythene - Nylon, PVC, Polyvinyl alcohol; Rubber – uses in daily life. Polymers, and other important organic compounds.
17. Environmental Chemistry: Different types of pollutions, acid rains, Ozone and its reactions, effects of depletion of ozone layer, Green house effect and global warming, Green Chemistry as an alternative tool for reducing pollution.
18. Metallurgy: Occurrence of Metals. Minerals, Ores - Examples. Extractions of metals – activity series and related metallurgy, flow chart of steps involved in the extraction of metals from ore. Refining metals, Electrolytic refining, Corrosion – Prevention of Corrosion. Alloys and their uses.

Syllabus for Chemical and Metallurgical Supervisor Exam Group

1. Fuels: Classification - Solid. Liquid & Gaseous fuels. Coal, Metallurgical coke, Petroleum. Producer Gas, Water Gas, Coal Oven Gas, Blast Furnace Gas and Natural Gas.
2. Material Science: Atomic Arrangement in Materials, Bonding in Metals, Corrosion, Ferrous metals: Mild steel, high carbon steel, stainless steel, high silicon steel,

molybdenum and tungsten steel. Nonferrous metals: copper, aluminium, lead, chromium, tin, brass, bronze and Monel. Non-metals: Glass, Enamels, chemical stone wares. graphite, wood, plastics, rubber, ebonite lining materials.

3. Engineering Polymers: Polymers. Polymerization, Industrial Polymers - Manufacturing and Industrial applications.

4. Thermodynamics: Laws of thermodynamics and their applications. Heat transfer by Conduction, Convection. Radiation. Refrigerating cycles. Combustion cycle for I.C. engines.

5. Applied Chemistry: Water, Cement. Lubricants. Explosives and Propellants. Important Industrial Chemicals: Industrial Method of preparation, properties and major industrial uses of: Ammonium Chloride. Ammonium Nitrate. Ammonium Sulphate. Calcium Phosphate (Super phosphate), Benzene (Benzol). Carbon Tetrachloride. Cresol, Ethyl Alcohol (Ethanol), Glycerine (glycerol) and Melamine.

6. Applied Physics: Friction, Equilibrium of Forces and Couples. Concepts of stress & Strain, Optics. Basic Digital Electronics, Nuclear Physics. Radio-activity. Solid State Physics, Semiconductor, Diodes. Transistors, D.C.

Motor. Transformers.
7. Basic Computer Science - Hardware & Software: Hardware, Operating System, Data base Management System, Programming Languages. Networking. Internet & World Wide Web.
8. Instrumentation & Measurement: Temperature & Pressure Measurement.
9. Energy, Environment & Ecology: Sources of Energy - Renewable & Non-Renewable, Ecosystem and its cycles & biodiversity. Pollution - Air, Water. Sound. Soil/Land and its management.
10. Basic Mechanical Engineering Mechanism: Velocity analysis: Transmission of Motion by direct contacts: Gears trains various types. Belt drives stepped pulley; chain drive. Strength of Materials: Stress, Strain and Elasticity. Thermal Stress. Torsion of a circular shaft. Shearing force and bending moment in beams. Fluid Mechanics: Fluid Properties. Bernoulli's equation and its applications. Losses in pipe fittings: flow measurements. Manufacturing Processes like Casting, Machining. Forging. Plastic deformation and metal forming.
11. Welding: Gas & Arc welding. Foundry: Pattern making, types & pattern allowances. Core box and core prints. Properties & Composition of good mould, sand,

Moulding defects.
12. Basic Electrical Engineering: Basic laws of Electricity, Various uses and effects of Electricity, Fuses. Relays etc. Principle of Generation of Electricity. Electrical circuit analysis. Transformers. Basics of AC (three & single phase) and DC machines. Semi-Conductors: Diodes, Transistors including junction transistors. Basic Knowledge on Rectifiers, filters, amplifiers. Modulation and Demodulation. Basic Digital Electronics.
13. Basic Civil Engineering: Building Materials like Stones, bricks. cement, lime, timber- types, properties, test & uses, laboratory tests. Concrete and mortar Materials. Building Construction: Foundations, RCC footings, brick masonry walls, plastering and pointing, floors, roofs, Doors, windows, lintels, staircases. R.C.C. and Steel Structures Surveying: Instruments. Measurement of distances, directions. elevations. Mapping details and contouring.