नॉर्दर्नकोलफील्ड्सलिमिटेड
(मिनिरत्नकंपनी)
(कोलइण्डियालिमिटेडकीअनुषंगीकंपनी)

एन सी एल
NCL

Northern Coalfields Limited
(AMiniratna Company)
(A subsidiary of Coal India Limited)

श्रमशक्तिविभाग/ Manpower Department

Digital India

स्वच्छ भारत
एक कदम स्वच्छता की ओर

CIN- U10102MP1985GOI003160
An ISO: 9001, ISO: 14001 & OHSAS: 18001 Certified Company
पोस्ट-सिगंरौलीकोलियरी,जिला- सिगंरौली,म.प्र., पिन 486889/ Post- Singrauli Colliery, Distt- Singrauli, M.P. PIN-486889
Phone: 07805- 266808, (FAX) 266640 email: gmadmin.ncl@coalindia.inwebsite : www.nclcil.in

संदर्भ: NCL/PD/Sing/MP&R/2020/ E-215

Date: 19/11/2020

सूचना / Notice

Regarding: Publication of syllabus

In reference to the Employment Notification ref no: 188 dated 22/02/2020 & 466, dated 10/07/2020 for filling different vacancies through direct recruitment pertaining to different posts as given below, syllabus for written test is hereby enclosed with this notice for all concerned.

विभिन्न पदो की रिक्तियों को, जैसा की नीचे दी गयी टेबल मे अंकित है, सीधी भर्ती के माध्यम से भरने हेतु निर्गत रोजगार अधिसूचना संदर्भ संख्या: .188 दिनांकित 22/02/2020 एवं रोजगार अधिसूचना संदर्भ संख्या: 466 दिनांकित 10/07/2020 के संदर्भ मे आयोजित होने वाली लिखित परीक्षा की विस्तृत विषय वस्तु इस सूचना के साथ सभी संबंधितों के सूचनार्थ संलग्न की जा रही है ।

S.N./ क्रम संख्या	Employment Notification Reference/ रोजगार अधिसूचना संदर्भ	Post Name/ पद नाम
1.	Employment Notification Ref No: NCL /HQ /PD / Manpower /DR/2019-20/188, dated 22/02/2020	Accountant/ Cost Accountant Tech. Grade A.
		Overseer Grade C
		Amin Grade D
		Junior Chemist T&S Grade D
2.	Employment Notification Ref No: NCL/HQ/PD/ Manpower /DR/2019-20/466 dated 10/07/2020	Technician Fitter (Trainee) Cat. III
		Technician Electrician (Trainee) Cat. III
		Technician Turner (Trainee) Cat. III
		Technician Machinist (Trainee) Cat. III
		Technician Welder (Trainee) Cat. II
		Assistant Foreman (E&T) (Trainee) Grade C
		Assistant Foreman (Mechanical) (Trainee) Grade C

19/11/2020

(चार्ल्स जुस्टर)
महाप्रबंधक (कार्मिक) ,एनसीएल

Section A (1-70 questions, MCQ of one mark each)-70 Marks

खण्ड ए (1-70 प्रश्न, 70 वस्तुनिष्ठ प्रश्न प्रत्येक 1 अंक का) -70 अंक

Questions related to technical knowledge of discipline as per current curriculum of Indian Universities/Institutes (Indicative syllabus has been given below)/ भारतीय विश्वविद्यालयों/संस्थानों के वर्तमान पाठ्यक्रम के अनुसार तकनीकी ज्ञान से संबंधित प्रश्न (सांकेतिक पाठ्यक्रम नीचे दिया गया है)

Detailed Syllabus for Section A (Technical section specific to different post) has been given in subsequent pages.

Name of the Post: Overseer Grade-C

1. Estimating
2. Costing
3. General Civil Engineering
4. Construction or Structure Engineering and Drawing
5. Valuation
6. Soil Mechanics
7. Structural Analysis
8. Building Materials
9. Mechanics
10. Concrete Structures
11. Steel Structures
12. Construction
13. Water Requirements
14. Hydraulics
15. Hydrology
16. Highway Planning
17. Traffic Engineering
18. Projections
19. Errors and Adjustments
20. Environmental Engineering
21. Surveying
22. Coordinate System
23. Curves
24. Measurements of distance and directions

Name of the Post: Amin (Tr), Gr. C

1. Surveying of Site, with surveying instruments and plot the same and able to calculate the area with meter. Reducing and enlarging of plans.
2. Entering in field book and Plotting.
3. Calculating Area of Site.
4. Instruments and accessories employed for survey works, their uses and application.
5. Read and use of Revenue Plans and Scale.
6. Knowledge of related works.
7. Surveying

a) Theodiolite Survey, Total Station and its uses, Method of Plotting, Clerk adjustment of errors.
b) Open and Closed traverse and their application.
c) Calculation of area from traverses and determination of heights.

8. Estimation and Costing, analysis of rates of typical items, abstracting and valuation.
9. Thorough Knowledge of conventional signs and symbols.
10. Knowledge of Drawings Plans and Sections.
11. Knowledge to operate computer and able to draw various drawing using autocad.

Etc. as per the courses offered by the Recognized Institutes

Name of the Post: Jr. Chemist T&S Grade D

1. Atomic Structure: Bohr's model and its limitations, concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg's uncertainty principle, Schrodinger wave equation; Interpretation of wave function, particle in one-dimensional box, quantum numbers, hydrogen atom wave functions; Shapes of s, p and d orbitals.rules for filling electrons in orbitals – Aufbau principle, Pauli's exclusion principle and Hund's rule, electronic configuration of atoms, stability of half-filled and completely filled orbitals.

2. Chemical Bonding: Ionic bond, characteristics of ionic compounds, lattice energy, Born-Haber cycle; covalent bond and its general characteristics, polarities of bonds in molecules and their dipole moments; Valence bond theory, VSEPR theory, concept of resonance and resonance energy; Molecular orbital theory (LCAO method); bonding in H2+, H2, He2+ to Ne2, NO, CO, HF, and CN– ; Comparison of valence bond and molecular orbital theories, bond order, bond strength and bond length.

3. Solid State: Crystal systems; Designation of crystal faces, lattice structures and unit cell; Bragg's law; X-ray diffraction by crystals; Close packing, radius ratio rules, calculation of some limiting radius ratio values; Structures of NaCl, ZnS, CsCl and CaF2; Stoichiometric and non-stoichiometric defects, impurity defects, semi-conductors.

4.The Gaseous State and Transport Phenomenon: Equation of state for real gases, intermolecular interactions and critical phenomena and liquefaction of gases, Maxwell's distribution of speeds, intermolecular collisions, collisions on the wall and effusion; Thermal conductivity and viscosity of ideal gases.

5. Liquid State: Kelvin equation; Surface tension and surface energy, wetting and contact angle, interfacial tension and capillary action.

6. Thermodynamics: Work, heat and internal energy; first law of thermodynamics; Second law of thermodynamics; entropy as a state function, entropy changes in various processes, entropy– reversibility and irreversibility, Free energy functions; Thermodynamic equation of state; Maxwell relations; Temperature, volume and pressure dependence of U, H, A, G, Cp and Cv; J-T effect and inversion temperature; criteria for equilibrium, relation between equilibrium constant and thermodynamic quantities; Nernst heat theorem, introductory idea of third law of thermodynamics.

7. Phase Equilibria and Solutions: Clausius-Clapeyron equation; phase diagram for a pure substance; phase equilibria in binary systems, partially miscible liquids–upper and lower critical solution temperatures; partial molar quantities, their significance and determination; excess thermodynamic functions and their determination.

8. Electrochemistry: Debye-Huckel theory of strong electrolytes and Debye-Huckel limiting Law for various equilibrium and transport properties. Galvanic cells, concentration cells; electrochemical series, measurement of e.m.f. of cells and its applications fuel cells and batteries. Processes at electrodes; double layer at the interface; rate of charge transfer, current density; over potential; electroanalytical techniques: Polarography, amperometry, ion selective electrodes and their uses.

9. Chemical Kinetics: Differential and integral rate equations for zeroth, first, second and fractional order reactions; Rate equations involving reverse, parallel, consecutive and chain reactions;

branching chain and explosions; effect of temperature and pressure on rate constant; Study of fast reactions by stop-flow and relaxation methods; Collisions and transition state theories.

10. Photochemistry: Absorption of light; decay of excited state by different routes; photochemical reactions between hydrogen and halogens and their quantum yields.

11. Surface Phenomena and Catalysis: Absorption from gases and solutions on solid adsorbents, Langmuir and B.E.T. adsorption isotherms; determination of surface area, characteristics and mechanism of reaction on heterogeneous catalysts.

12. Bio-inorganic Chemistry: Metal ions in biological systems and their role in ion transport across the membranes (molecular mechanism), oxygen-uptake proteins, cytochromes and ferredoxins.

13. Features of Coordination Chemistry & Organic Reaction Mechanism: Coordinationchemistry, coordination number, chelate effect, coordination complexes and their applications.Electrophilic substitution reactions in aromatic systems. Some Name reactions viz. Hoffman'srearrangement, Beckman's reaction, Riemer-Tiemann reaction, Skraup synthesis, etc.

14. Main Group Chemistry: Boranes, borazines, phosphazenes and cyclic phosphazene, silicates and silicones, Interhalogen compounds; Sulphur – nitrogen compounds, noble gas compounds.

15. General Chemistry of 'f' Block Elements: Lanthanides and actinides; separation, oxidation states, magnetic and spectral properties; lanthanide contraction.

16. Delocalised Covalent Bonding: Aromaticity, anti-aromaticity; annulenes, azulenes, tropolones, fulvenes, sydnones.

17. (i) Reaction Mechanisms: General methods (both kinetic and non-kinetic) of study of mechanism of organic reactions: isotopic method, cross-over experiment, intermediate trapping, stereochemistry; energy of activation; thermodynamic control and kinetic control of reactions.

(ii) Reactive Intermediates: Generation, geometry, stability and reactions of carbonium ions and carbanions, free radicals, carbenes, benzynes and nitrenes.

(iii) Substitution Reactions: SN1, SN2 and SNi mechanisms; neighbouring group participation; electrophilic and nucleophilic reactions of aromatic compounds including heterocyclic compounds– pyrrole, furan, thiophene and indole.

(iv) Elimination Reactions: E1, E2 and E1cb mechanisms; orientation in E2 reactions–Saytzeff and Hoffmann; pyrolyticsyn elimination – Chugaev and Cope eliminations.

(v) Addition Reactions: Electrophilic addition to C=C and C≡C; nucleophilic addition to C=0, C≡N, conjugated olefins and carbonyls.

(vi) Reactions and Rearrangements: (a) Pinacol-pinacolone, Hoffmann, Beckmann, Baeyer–Villiger, Favorskii, Fries, Claisen, Cope, Stevens and Wagner-Meerwein rearrangements.(b) Aldol condensation, Claisen condensation, Dieckmann, Perkin, Knoevenagel, Witting, Clemmensen, Wolff-Kishner, Cannizzaro and von Richter reactions; Stobbe, benzoin and acyloin condensations; Fischer indole synthesis, Skraup synthesis, Bischler-Napieralski, Sandmeyer, Reimer-Tiemann and Reformatsky reactions.

18. Pericyclic Reactions: Classification and examples; Woodward-Hoffmann rules – electrocyclic reactions, cycloaddition reactions [2+2 and 4+2] and sigmatropic shifts [1, 3; 3, 3 and 1, 5] FMO approach.

19. (i) Preparation and Properties of Polymers: Organic polymers–polyethylene, polystyrene, polyvinyl chloride, teflon, nylon, terylene, synthetic and natural rubber.**(ii) Biopolymers**: Structure of proteins, DNA and RNA.

20.Synthetic Uses of Reagents:OsO4, HIO4, CrO3, Pb(OAc)4, SeO2, NBS, B2H6, Na-Liquid NH3, LiAlH4, NaBH4, n-BuLi and MCPBA.

21. Photochemistry:Photochemical reactions of simple organic compounds, excited and ground states, singlet and triplet states, Norrish-Type I and Type II reactions.

22. Spectroscopy:Principle and applications in structure elucidation:(i) Rotational: Diatomic molecules; isotopic substitution and rotational constants.(ii) Vibrational: Diatomic molecules, linear triatomic molecules, specific frequencies of functional groups in polyatomic molecules.(iii) Electronic: Singlet and triplet states; n p* and p p* transitions; application to conjugated double bonds and conjugated carbonyls–Woodward-Fieser rules; Charge transfer spectra.(iv) Nuclear Magnetic Resonance (1H NMR): Basic principle; chemical shift and spin-spin interaction and coupling constants.(v) Mass Spectrometry: Parent peak, base peak, metastable peak, McLafferty rearrangement.

23. Pharmaceutical Compounds: Structure and therapeutic uses of antipyretics: Paracetamol (with synthesis),Analgesics: Ibuprofen (with synthesis), Antimalarials: Chloroquine (with synthesis).An elementary treatment of Antibiotics and detailed study of chloramphenicol,Medicinal values of curcumin (haldi), azadirachtin (neem), vitamin C and antacid (ranitidine)

24. Environmental Chemistry: Environmental pollution - air, water and soil pollution, chemical reactions in atmosphere,smog, major atmospheric pollutants, acid rain, ozone and its reactions, effects of depletionof ozone layer, greenhouse effect and global warming- pollution due to industrial wastes,green chemistry as an alternative tool for reducing pollution, strategies for control ofenvironmental pollution.

25. Energy and Environment: Sources of energy: Fossil and non-fossil fuels,**Coal**- Origin, formation, types, classification, testing, Physical and chemical Properties, Coal Byproducts and usage;Petrol and Natural gas. Nuclear Fusion/Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel etc.Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its Management

Etc. as per the courses offered by various Universities across country.

Post Name: Accountant / Cost Accountant , Tech Grade -A

Financial Accounting

1. Basics- Meaning, Scope and Significance of Accounting - Accounting Principles, Concepts and Conventions - Capital and Revenue Transactions – Depreciation - Rectification of Errors ,
2. Issue of Share capital, Redemption of preference shares; Redemption of debentures; Accounting for bonus issue and right issue,
3. Preparation of financial statements of profit oriented organizations – Statement of Profit and Loss, Balance Sheet and Cash Flow Statement,
4. Preparation of financial statements of Non-profit oriented organizations
5. Financial Statement of Companies
6. Hire – purchase Transaction and Installment Sale Transactions
7. Accounts from Incomplete Records
8. Accounting for partnership firms;: Admission, retirement, death, dissolution of firm and Amalgamation of firms,
9. Branch and Department Accounts
10. Consignment Accounting and Joint Venture Accounting
11. Government Accounting
12. Basic Knowledge of Accounting standards and Ind AS.

Law and Ethics

1. **Commercial Laws-** Laws of Contracts, Laws related to Sale of goods, Negotiable instrument Act 1881, Indian Partnership Act, 1932., Limited Liability Partnership Act, 2008
2. **Industrial Laws:** Payment of Gratuities Act, 1972, Payment of Bonus Act, 1965, Minimum wages Act, 1948
3. **Companies Act, 2013-** Company types, promotion, formation and related procedures i.e, Sec 1 to Sec 122 of Companies Act, 2013. Director-Role, Responsibilities, Qualification, disqualification, appointment, retirement, resignation, removal, remuneration and powers,

Director Identification Number.

4. Business Ethics

Direct Taxation

1. Introduction to income Tax Act
2. Residence and scope of Income
3. Income which do not form part of Total Income
4. Heads of Income
5. Clubbing Provisions, set-off and carry forward of losses, deductions
6. Computation of Gross Taxable Income and tax payable
7. Advance Tax, TDS and TCS
8. Provision of filing returns of Income and Self-assessment
9. Basic concepts of ICDS.

Indirect Taxation

1. GST in India
2. Basic understanding of GST and preliminary provision
3. Administration in GST
4. Levy and collection of Tax
5. Time and value of supply
6. Input Tax Credit
7. Registration
8. Tax Invoice, Credit note and Debit Notes
9. Accounts and records under GST
10. GST Returns
11. Payment of GST

12. Audit under GST

13. Advance ruling under GST

14. Basic Knowledge of Customs Act.

Cost and Management Accounting

1. Definition, Objectives and Scope of Cost Accounting and its relationship with Financial Accounting, Management Accounting, Cost objects, cost centers and cost units
2. Elements of Cost including material, Labour, direct expenses and Overheads, Classification of Cost
3. Job Costing, Batch costing, Contract Costing, Operating Costing, Process Costing
4. Cost Sheet and Reconciliation of cost accounting records with financial accounting
5. Basic understanding of standard costing, variance analysis, marginal costing and Budgetary control
6. Basic understanding of Cost Accounting Standards(CAS)
7. Tools for financial analysis and planning including ratio analysis, Fund Flow Statement, Cash Flow Statement
8. Working capital management
9. Cost of capital
10. Basic understanding of Capital Budgeting & Investment Analysis
11. Debtor Management, Creditor Management, Inventory Management

Auditing

1. Auditing concept
2. Provisions related to Audit under Companies Act,
3. Internal check, Internal Control and Internal Audit
4. Branch Audit and Joint Audit

5. Statutory Audit vs Internal Audit\

6. Audit of divisible profit and dividend\

7. Cost Audit and Secretarial Audit

Name of the Post: Assistant Foreman(E&T)

Networks Theory

1. Basic of Network Theory. Nodal and Mesh analysis. Network Theorems- Superposition Theorem, Thevenin and Norton's Theorem, maximum power transfer Theorem. Star-Delta transformation, Duality. Steady state sinusoidal analysis, Time domain analysis of simple linear circuits, Frequency domain analysis of RLC (Series and Parallel) circuits. Two port network parameters. Graph Theory.

2. **Digital Electronics**
3. Number systems, Code converters: BCD, Binary, HEX, Octal other codes, Combinatorial Circuits. Boolean algebra. Karnaugh map. CMOS implementations. Arithmetic Circuits. Multiplexers. Encoder & Decoders. Sequential circuits- latches and all flip-flops, counters, shift-registers. Data converters- ADC (Analog to Digital Converter) and DAC (Digital to Analog Converter).

4. **Semiconductor memories-** ROM (Read Only Memory), SRAM (Static Read Access Memory), DRAM (Dynamic read Access Memory)
5. **Microprocessor (8085- 8 Bit)** - Architecture, All Instruction, Programming, memory.

Signal and System

6. Signal Operation- Time Shifting, Scaling, & Reversal. System- Linear, causality, stability. Fourier series and Fourier transform representations, sampling theorem. Discrete-Time signals - discrete-time Fourier transform, DFT (Discrete Fourier transform), FFT, and Z-transform. LTI systems- Properties, frequency response, group delay, phase delay.

Electronic Devices Circuits (EDC)

7. Energy bands in intrinsic and extrinsic silicon. Carrier transport- diffusion current, Drift current, Mobility and Resistivity, Diffusion constant, Generation and recombination of carriers. Diode, BJT (Bipolar Junction Transistor). P-N junction Transistor, Zener diode, MOSFET, LED (Light Emitting Diode), a photodiode and solar cell. Thyristor (SCR), Triac Diode, GTO, an IGBT, DC to DC conversion, Rectifier, Chopper.

Analog Electronics

8. BJT (Bipolar Junction Transistor), and MOSFETs, Simple diode circuits- clipping, clamping, and rectifiers. BJT and MOSFET amplifiers- multi-stage, differential, feedback, power and operational, Operational Amplifier circuits, Active filters. Oscillators- criterion for oscillation, RC Phase Shift, using transistor and FET, Wein bridge, Clapp's, Colpitts oscillator only Formula. Function generators, wave-shaping circuits and 555 timers, Voltage reference circuits, Power supplies- ripple removal and regulation. Cathode Ray Oscilloscopes (CRT), Multimeters, and Digital voltmeters.

Control Systems

9. Basic control system, Transfer function meson's formula, Block diagram representation, Signal flow graph. Transient and steady-state analysis of LTI systems- First and Second Order System. Frequency response- Routh-Hurwitz criterion, Polar Plot analysis, and Nyquist stability criteria, Bode plot and root-locus plots, Calculation of Gain and Phase Margin, Lag, lead and lag-lead compensation. P, PI, PD, and PID. State variable Analysis- State model solution of LTI systems, State model to transfer function, Controllability, and Observability.

Analog Communication System

10. Amplitude modulation and demodulation For Sinusoidal, Rectangular and Triangular Signal, Angle modulation(Frequency and Phase Modulation) and demodulation, AM and FM Spectrum Analysis, super heterodyne receivers.

Digital communications

11. PCM (Pulse Code Modulation), DPCM (Delta Pulse Code Modulation), digital modulation schemes. Bandwidth Calculation, SNR (Signal to Noise ratio) and BER/Probability error for digital modulation, Fundamentals of error correction, Hamming codes, Inter-symbol interference. Basics of TDMA, FDMA, and CDMA (Code-division Multiple access). Information theory- Entropy, mutual information and channel capacity theorem.

Electromagnetics

12. Electrostatics, Maxwell's equations, wave equation, Poynting theorem & vector. Plane waves- Reflection and refraction, polarization, phase and group velocity, calculation of skin depth. Transmission lines- Equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart. Waveguides- Basic of Waveguides

13. **Antennas-** Basic Concept, Definition, Types of Antenna, radiation pattern, gain, and directivity return loss etc.

Computer Networking

14. Network features-Network topologies, protocols- TCP/IP, UDP, FTP, models, types, network components, network medias, Specification and standards, types of cables, UTP, STP, Coaxial cables. Network components like hub, Ethernet switch, router, NIC Cards, connectors, media and firewall. Difference between PC & Server.

Voice Communication

15. **Telephone instruments and signals:** Introduction, the subscriber loop, standard telephone set, basic call procedure, cordless telephones, electronic telephones. **Telephone circuit:** Introduction, the local subscriber loop, channel noise and units of power measurements, transmission parameters, voice frequency circuit arrangements. **Public telephone network:** Transmission system, public telephone network, automated central office switches and exchanges, telephone switching hierarchy, common channel signaling system. **Multiplexing of telephone channels:** TDM, digital hierarchy, digital carrier line encoding, T-carrier systems, digital carrier frame synchronization, FDM, WDM. **Digital telephony:** Introduction, voice digitization, TDM of PCM signals, digital carrier, Fractional T-Carrier Service, Data Terminal, Digital Carrier Line Encoding, Error Detection, T Carrier System, T-1 Carrier System.

Name of the Post: Assistant Foreman (Mechanical)

1. Theory of Machines and Machine Design Concept of simple machine, Four bar linkage and link motion, Flywheels and fluctuation of energy, Power transmission by belts – V-belts and Flat belts, Clutches – Plate and Conical clutch, Gears – Type of gears, gear profile and gear ratio calculation, Governors – Principles and classification, Riveted joint, Cams, Bearings, Friction in collars and pivots.
2. Engineering Mechanics and Strength of Materials:
3. Equilibrium of Forces, Law of motion, Friction, Concepts of stress and strain, Elastic limit and elastic constants, Bending moments and shear force diagram, Stress in composite bars, Torsion of circular shafts, Bucking of columns – Euler's and Rankin's theories, Thin walled pressure vessels.

4. Thermal Engineering Properties of Pure Substances : p-v & P-T diagrams of pure substance like H2O, Introduction of steam table with respect to steam generation process; definition of saturation, wet & superheated status. Definition of dryness fraction of steam, degree of superheat of steam. H-s chart of steam (Mollier's Chart).
   1 st Law of Thermodynamics : Definition of stored energy & internal energy, 1st Law of Thermodynamics of cyclic process, Non Flow Energy Equation, Flow Energy & Definition of Enthalpy, Conditions for Steady State Steady Flow; Steady State Steady Flow Energy Equation.
   2 nd Law of Thermodynamics : Definition of Sink, Source Reservoir of Heat, Heat Engine, Heat Pump & Refrigerator; Thermal Efficiency of Heat Engines & co-efficient of performance of Refrigerators, Kelvin – Planck & Clausius Statements of 2nd Law of Thermodynamics, Absolute or Thermodynamic Scale of temperature, Clausius Integral, Entropy, Entropy change calculation of ideal gas processes. Carnot Cycle & Carnot Efficiency, PMM-2; definition & its impossibility.
5. Air standard Cycles for IC engines : Otto cycle; plot on P-V, T-S Planes; Thermal Efficiency, Diesel Cycle; Plot on P-V, T-S planes; Thermal efficiency.
   IC Engine Performance, IC Engine Combustion, IC Engine Cooling & Lubrication. Rankine cycle of steam : Simple Rankine cycle plot on P-V, T-S, h-s planes, Rankine cycle efficiency with & without pump work.
6. Boilers; Classification; Specification; Fittings & Accessories : Fire Tube & Water Tube Boilers. Air Compressors & their cycles; Refrigeration cycles; Principle of a Refrigeraton Plant; Nozzles & Steam Turbines
7. Fluid Mechanics & Machinery Properties & Classification of Fluid : ideal & real fluids, Newton's law of viscosity, Newtonian and Non-Newtonian fluids, compressible and incompressible fluids. Fluid Statics : Pressure at a point. Measurement of Fluid Pressure : Manometers, U-tube, Inclined tube. Fluid Kinematics : Stream line, laminar & turbulent flow, external & internal flow, continuity equation. Dynamics of ideal fluids : Bernoulli's equation, Total head; Velocity head; Pressure head; Application of Bernoulli's equitation. Measurement of Flow rate Basic Principles : Venturimeter, Pilot tube, Orifice meter. Hydraulic Turbines : Classifications, Principles. Centrifugal Pumps : Classifications, Principles, Performance.
8. Production Engineering Classification of Steels : mild steal & alloy steel, Heat treatment of steel, Welding – Arc Welding, Gas Welding, Resistance Welding, Special Welding Techniques i.e. TIG, MIG, etc. (Brazing & Soldering), Welding Defects & Testing; NDT,

Foundry & Casting – methods, defects, different casting processes, Forging, Extrusion, etc, Metal cutting principles, cutting tools, Basic Principles of machining with (i) Lathe (ii) Milling (iii) Drilling (iv) Shaping (v) Grinding, Machines, tools & manufacturing processes.

Etc. as per the courses offered by the Recognized Institutes

Name of the Post: Technician Fitter (Trainee) Cat. III

1. Basic arithmetic calculation, algebraic, trigonometric, statistics
2. Basic knowledge of system of units and its conversions
3. Basic 10th standard knowledge of Electricity
4. Knowledge of properties of materials
5. Basic information related to jigs, drilling and other machining processes and principles
6. Basic knowledge of pipe fittings, belt drive, gear train etc.
7. Knowledge of different measuring and machining tools and its principles
8. General concept of limits, fits and tolerances
9. Knowledge of general safety rules at work place, use of fire extinguishers
10. General information related to Vehicle and Internal combustion engine

    Etc. as per the courses offered by the Recognized Institutes

Name of the Post: Technician Electrician (Trainee) Cat. III

Electrical Fundamentals: Ohm's Law, Kirchhoff's Laws, Series & Parallel combination of Resistors, Inductors & Capacitors. Wheatstone bridge, PVC wires, Conductors & cables. Wire joints, Soldering. Heating, lighting, magnetic & chemical effect of electric current. Joule's law. Electrolysis & its laws. Cells and Batteries- Primary & secondary cell, Lead Acid battery, Hybrid cell, Alkaline cell. Charging of battery. Care & Maintenance of Battery.

Magnetic Circuits: Terminology used in magnetic circuit, Principle of electro magnet, Capacitor & its types. Faraday's laws of Electromagnetic Induction. Fleming's rule, B-H Curve. RLC circuit – series & parallel resonance.

DC generators: Working principle, Types-Series, Shunt & Compound Generator. EMF equation, Characteristics, commutation, Efficiency, Regulation& Applications.

DC Motors: Principle, Types- Series, Shunt & Compound Motors. Characteristics curve, commutation. Applications of DC motors. Necessity of starter, Working of starters (3 point& 4 point). Speed control of DC Shunt motor (armature & Field control). Trouble shooting –Care and maintenance

Active& Reactive Power: Calculation for Work, Power & Energy, Power factor. Causes & effects of low power factor. Methods of Improving power factor. Calculation of capacitor banks. Automatic power factor correction (APFC) Panels. Three phase three wires & three phase four wires system. Three phase Power.

Transformers: Working Principle, Construction. Classification of Transformers, EMF equation ,rating, Loading, Losses & Efficiency Regulation, Parallel Operation, Cooling methods, Transformer oil testing. Care and maintenance, Protective devices. Tap Changer –ON load and OFF load. Auto transformer, Instrument Transformer- CT & PT, Welding Transformer.

Measuring Instruments: -PMMC, MI Meters working principle and construction. Digital meters. Megger & Earth tester, Multimeter. Calibrations of meters. Terminology used in Illumination and calculations. Types of Lamps-Incandescent Lamp and Discharge Lampfluorescent, HPMV, HPSV Lamps. Drum Switch, Lighting calculations, Energy efficient lighting systems (CFL, LED etc.), Two wattmeter method of 3 phase power measurement.

Semi-conductor Devices : diodes , Characteristics , Zener diode, Rectifiers & filter circuits.

Squirrel Cage & Wound Rotor type Induction Motor: Construction , parts , working principle, Concept of rotating magnetic field, Applications. Types of starters-DOL, Star delta, Auto transformer starter etc. Rotor resistance type starter. Introduction to Speed control of 3 phase Induction motor. Torque-speed characteristics. Losses, efficiency, Classification, Working Principle & uses. AC Motor stator Re-winding. Single phase & Three phase winding development diagram

Synchronous Motor : Construction, Working Principle, Starting Method. Effect of change of excitation on load. V-curve and Inverted V -curve. Power factor correction.

Electrical Drives: DC drive. AC drive. Preventive& Break down Maintenance of DC / AC machines, Voltage stabilizer, UPS, Inverter.

Basics of Wiring: Power & control circuits wiring. Machine control cabinet /control panel layout, assembly. control elements- Push button switches, contactor, overload Relay etc. Concept of neutral and earth. Earthing, types, methods of reducing earth resistance, Earth tester. Star & Delta connections. Concept-Principle of plan estimation and cost-preparation of wiring layout domestic/Industrial/Commercial. I.E rules for multi-storeyed building. National Electrical Code, SWG, common electrical Accessories – MCB, ELCB, MCCB, RCCB etc. Comparison between different types of wirings. Installation, Testing methods – Wiring estimations & cost.

Basics of Thermal Power: Plant layout, components and working principle of thermal power plant.

Non-conventional energy resouces : Working principle of Wind and solar power generation.

Electrical Substation: Single Line Diagram of Substations. Electric supply system EHVAC transmission. Advantages of high voltage transmission Overhead lines: - Poles& Towers, bushings, Insulators & its types. Corona effect, Bundle conductors, Sag, Skin effect& Ferranti effect. Fault studies. 3 phase service-cable fault. Sub- Station HT/LT –Function, equipment, types of distribution system. Protective relays-overcurrent, IDMT, overvoltage, differential, distance relay. Circuit breakers-lightning arrestor used in HT line. Cable- different types of cables, cable rating, derating factor. Fire Fighting, Safely handling Tools & Equipment, Rescue of person who is in contact with live wire, Treat a person for electric shock/ injury.

Etc. as per the courses offered by the Recognized Institutes

Name of the Post: Technician Turner (Trainee) Cat. III

1. Safety and precautions observed in the in the industry, stores procedures. First aid. Operation of electrical mains.PPEs.5S concept & its application. Response to emergencies eg; power failure, fire, and system failure.
2. Measurement, line standard and end standard, steel rule-different types, graduation and limitation. Hammer and chisel-materials, types and uses. Prick punch and scriber.
3. Vice – types and uses, Files-different types of uses, cut, grade, shape, materials etc.
4. Try square-different types, parts, material used etc. Calipers-types and uses (firm joint).Vee – block, scribing block, straight edge and its uses. Hacksaw-their types & uses.
5. Center punch- materials, construction &material uses. Drill machine-different parts. Hacksaw blades- sizes , different Parts. Hacksaw blades-sizes, different pitch for different materials. Nomenclature of drill.
6. Surface plate its necessity and use. Tap, -different types (Taper 2nd and bottoming) care while tapping. Dies different types and uses. Calculation involved to find Out drill size (Metric and Inch).
7. Definition of machine & machine tool and its classification. History and gradual development of lathe.Classification of lathe in Function and construction of different parts of Lathe.Types of lathe drivers, merit and demerit.Description in details-head stock cone pulley type-all geared type-construction & function. Tumbler gear set. Reducing speed-necessary & uses. Back Gear Unit –its construction use.Lathe cutting tool-different types, shapes and different angles (clearances and rake), specification of lathe tools
8. Combination drill- appropriate selection of size from chart of combination drill.Drill, chuck- its uses.
9. Vernier caliper-its construction, principle graduation and reading, least count etc. Digital vernier caliper.Outside micrometer –different parts, principle, graduation, reading, construction.Digital micrometer. Cutting speed, feed depth of cut, calculation involved-speed feed R.P.M. etc. recommended for different materials.
10. Different types of micrometer, Outsidemicrometer. Vernier scale graduation and reading. Sources of error with micrometer & how to avoid them. Use of digital measuringinstruments. Lathe accessories, chuck independent, self centering, collet, magnetic etc., its function, construction and uses.
11. Drills-different parts, types, size etc., different cutting angles, cutting speed for different material. Boring tool. Counter - sinking and Counter boring. Letter and number drill, core drill etc. Reamers-types and uses. Lubricant and coolant-types, necessity, system of distribution, selection of coolant for different material: Handling and care.
12. Driving plate. Face plate & fixed &traveling steadies- construction and use. Transfer caliper-its construction and uses. Lathe centers-types and their uses. Lathe carrier-function, types & uses.
13. Knurling meaning, necessity, types, grade, cutting speed for knurling. Lathe mandrel different types and their uses. Concept of interchangeability, Limit, Fit and tolerance as per BIS :919-unilateral and bilateral system of limit, Fits- different types, symbols for holes and shafts. Hole basis &shaft basis etc. Representation of Tolerance in drawing.
14. Computer, windows, MS office, Internet, Web browser

Etc. as per the courses offered by the Recognized Institutes

Name of the Post: Technician Machinist (Trainee) Cat. III

Safety and precautions: Operation of electrical mains, PPEs. 5S concept & its application. Response to emergencies eg; power failure, fire, and system failure. Classification and types of chisels, files & uses, vices - its constructions and uses. Hammers and its types. Marking block, Steel rule, and calipers types and uses. Hacksaw blade, Hacksaw frame and its types. Drill bits- parts, types & uses.

Hand Taps & Dies: Types, applications. Tap and drill size, Thread Terminology. Forging tools and its types such as tongs, swage block, anvil etc. Heat treatment process Annealing, Normalising, Tempering, Hardening, case hardening. Vernier caliper and its parts, construction, principle & reading and use. Outside micrometer, its types and construction, parts, usage. Depth gauge, micrometers and dial test indicator - their parts and construction.

Shaper: principle, types of power transmission on shaping mechanism. Shaping parts, construction use of parts, quick return mechanism ratio etc. Tools of shaping machine and their angles and importance of angles. Methods of holding jobs, use of clamps, nuts & bolts V- blocks, angle plates shaping operations.Tool head - its parts and application, function of each part of tool head.

Shaping tools : Types, speed, feed, depth of cut. Surface finish as per ISI system.

Slotter : Principle, construction, details, driving mechanism, quick return motion and speed ratio. Classification of slotting machine. Job holding devices-vice, clamps, V-block, parallel block etc. Coolant & lubricant, types and uses. Use of circular marks on the table for slotting curves. Use of slotting tools with holder for internal operations.

Planing Machine : Parts, types, constructions, Driving mechanism of planer, quick return motion etc. Tool head of planer, its construction and function of each part v- block, clamps, bolts, step block and other holding devices. Cutting tools for Planer - their material and types. Templates, gauges, their fixtures and vices. Hydraulic mechanism of planer their advantages, disadvantages.

Lathe machine : Types, engine lathe construction, detail function of parts size and specification. Lathe tools their angles & uses. Driving mechanism, speed and feed mechanism & lathe accessories. Chucks-different types of job holding devices on lathe and advantages of each type. Mounting and dismounting of chucks. Taper introduction, types and uses. Calculations of tapers. Measurement of taper by sine bar and slip gauges.

Thread forms: Dimensions and screw cutting in a lathe calculations. Measurement of threads by three wire methods.

Milling machine: importance of milling machine, types and specification of milling machine, driving and feed mechanism of milling machine. Classification of milling cutters & their use. Parts and nomenclature.

Vernier height gauge: construction, graduations vernier setting & reading, vernier bevel protractor, construction graduation setting and reading. Care and maintenance of vernier height gauge and bevel protractor. Different milling operations plain-face, angular, form, slot, gang and straddle milling etc. Up and down milling. Vernier gear tooth caliper, its construction and application in checking gear tooth.

Indexing: Definition & types. Indexing head constructional details, function of indexing plates and the sector arms. Calculation for various types of indexing.

Gears: Definition and types. Elements of a spur gear. Gear tooth of each form types, Spur gear calculations, curves and their uses. Grinding machine introduction, types, specification, their parts and functions & uses. Types of Abrasives and their uses, Glazing and loading of wheels. Helical gear elements and calculation. Geometry and uses of bevel gears. Quality control types of variation, causes of variation, measurement of testing, gear & error. Rack, its use & application. Rack cutting attachment, calculation for linear pitch, circular pitch, Gear ratio, Indexing movement, etc. Geometry and use of worm and worm wheel.

CNC technology: Difference between CNC and conventional lathes. Advantages and disadvantages of CNC machines over conventional machines. Schematic diagram of CNC system. Axes convention. Working of parts explained using multimedia CNC teachware. Parts shown on machine.

Programming: Sequence, formats, different codes, canned cycles. Absolute and incremental programming. Tool nose radius compensation (G41/42). Cutting tool materials, cutting tool geometry – insert types, holder types, insert cutting edge geometry. Cutting parameters - cutting speed, feed rate, depth of cut. Process planning, tool selection and cutting parameters selection. Explained using multimedia CNC teachware and CNC machine simulator.

Program execution in different modes: Single block, manual and auto. Tool and work offsets setting. Spiral-lead, helix angle and calculation. Cam Introduction development and use. Calculation for the machining time, machining allowances. Lubricant , coolants and their application.

Cam-lobe: Lead setting of dividing head calculation. Broaching methods of milling splines. Selection of cutters. Spiral milling lead, pitch, helix angle R.H. and L.H. swiveling the table in relation to the helix angle, selection of cutter for spiral milling. Calculations for spiral milling. Cam-types, application in modern machine tools, its special advantages, manufacturing process, calculation for milling a drum cam.

Etc. as per the courses offered by the Recognized Institutes

Name of the post: Technician Welder (Trainee) Cat. II

1. First Aid. Welding in Industry. Safety precautions in Shielded Metal Arc Welding, and Oxy-Acetylene Welding and Cutting. Arc and Gas Welding Equipments, tools and accessories . Various Welding Processes and its applications . Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc. Types of welding joints and its applications. Edge preparation and fit up for different thickness. Surface Cleaning.
2. Basic electricity applicable to arc welding and related electrical terms &definitions.
   Heat and temperature and its terms related to welding, Principle of arc welding. And characteristics of arc . Common gases used for welding & cutting, flame temperatures and uses. Chemistry of oxy-acetylene flame. Types of oxy-acetylene flames and uses.Oxy-Acetylene Cutting Equipment principle, parameters and application.
3. Arc welding power sources: Transformer, Motor Generator set, Rectifier and Inverter type welding machines and its care &maintenance. Advantages and disadvantages of A.C. and D.C. welding machines.
4. Welding positions as per EN &ASME : flat, horizontal, vertical and over head position. Weld slope and rotation. Welding symbols as per BIS & AWS. Arc length types & effects of arc length. Polarity: Types and applications.
5. Calcium carbide properties and uses.Acetylene gas properties and generating methods. Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor.
6. Oxygen gas and its properties, Production of oxygen by Air liquefaction .Charging process of oxygen and acetylene gases. Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders. Gas regulators, types and uses.
7. Oxy acetylene gas welding Systems (Low pressure and High pressure). Difference between gas welding blow pipe(LP & HP) and gas cutting blow pipe .Gas welding techniques. Rightward and Leftward techniques .Arc blow – causes and methods of controlling.Distortion in arc & gas welding and methods employed to minimize distortion .Arc Welding defects, causes and Remedies.
8. Specification of pipes, various types of pipe joints, pipe welding positions, and procedure. Difference between pipe welding and plate welding.Pipe development for Elbow joint, “T” joint, Y joint and branch joint .Manifold system.
9. Gas welding filler rods, specifications and sizes.Gas welding fluxes – types and functions. Gas Brazing &Soldering : principles, types fluxes & uses . Gas welding defects, causes and remedies.
10. Electrode : types, functions of flux, coating factor, sizes of electrode Coding of electrode as per BIS, AWS, Effects of moisture pick up. Storage and baking of electrodes.Special purpose electrodes and their applications.
11. Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature. Classification of steel. Welding of low, medium and high carbon steel and alloy steels.
12. Effects of alloying elements on steel .Stainless steel : types- weld decay and weldability. Brass – types – properties and welding methods. Copper – types – properties and welding methods. Aluminium and its alloys, properties and weldability, Welding methods .Arc cutting & gouging, Cast iron and its properties types.Welding methods of cast iron.

    Etc. as per the courses offered by the Recognized Institutes

Section B (30 MCQ of one mark each)- 30 Marks/ खण्ड बी (एक-एक अंक के 30 बहू विकल्पिये प्रश्न) - 30 अंक

This section is common for all Posts, will carry 30 questions belonging to/ यह अनुभाग सभी पदों के लिए समान है, जिसमें 30 प्रश्न होंगे::

I. ***General Knowledge*** –About India and its international relations, General Science etc/ सामान्य ज्ञान - भारत और उसके अंतरराष्ट्रीय संबंध, सामान्य विज्ञान आदि

II. ***General Awareness*** – About Sports, Defense, Books, Prizes, About Indian democracy, etc./ सामान्य जागरूकता - खेल, रक्षा, पुस्तकें, पुरस्कार, भारतीय लोकतंत्र के बारे में, आदि।

III. ***Reasoning, Verbal & Mental*** Ability – Synonym & Antonym (Hindi/English), Grammar, Relationship etc./तर्क, मौखिक और मानसिक क्षमता,पर्याय और विलोम (हिंदी/अंग्रेजी), व्याकरण, संबंध इत्यादि ।

IV. ***Quantitative aptitude*** – Work relationship, Profit & Loss, Speed etc / क्वांटिटेटीव एप्टीट्यूड - वर्क रिलेशनशिप, लाभ एवं हानि, गति इत्यादि।

Section A: Indicative Syllabus of Section A (Technical) of written test for appointment to different Supervisory & Technician positions/ विभिन्न पर्यवेक्षी और तकनीशियन पदों मे लिखित परीक्षा हेतु सेक्शन ए (तकनीकी) का सांकेतिक पाठ्यक्रम :-