**NTDCL Approved Content**

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| **Sr #** | **Name of Post & BPS** | **Proposed Areas Weightages** | **Course Content for Professional/ Technical Knowledge** |
| 1 | Test Inspector (BPS-15) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies **(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs **(15 Marks)** 3. Professional/ Technical Knowledge as per   Their qualification and experience given in the advertisement of each category of the posts. **(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**   |  |  |  | | --- | --- | --- | | **Section**  **A** | **Basic Electronics & Measuring systems.** | **20** | | Sub- Section  A-i: | Basic Electronics, Rectifiers, Converter, Thyristors. | 10 | | Sub- Section  A-ii: | Resistors, Capacitors, Inductors, Measuring Units (V, A, Watt, Var) &  Measuring Systems ,Power Factor | 10 | | **Section B** | **Grid Station Equipment & Protection systems.** | **20** | | Sub- Section  B-i: | Basics of Transformers (Power Transformers/DistributionTreanformer)/  Transmission lines CT's PT's | 10 | | Sub-  Section B-ii: | Protection systems of Transformer and  Transmission lines, Circuit Breakers, Disconnecting Switches, Bus Bars. | 10 | | **Section**  **C** | **AC and DC machines fundamentals.** | 20 | | Sub- Section  C-i: | DC battery, DC Machines. | 10 | | Sub- Section  C-ii: | AC Machines, Induction, Synchronous motors and Generators. | 10 | | Grand Total | | 60 | |
| 2 | Sub Station Operator-I(BPS-15) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies **(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs **(15 Marks)**   Professional/ Technical Knowledge as per their qualification and experience given in the advertisement of each category of the posts. **(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**   * Computer Applications   + Networking (LAN, WAN, Network, Internet, Browsing and Surfing)   + Basics of computers   + Input and Output Devices   + MS (Office - Word and Power Point) Application * Electrical Instrumentation   + ERRORS IN AM-METERS AND VOLTMETERS   + MULTIPLIER: Purpose of multiplier, its calculations and Construction   CLASSIFICATION OF INSTRUMENTS: Absolute instruments. Secondary instruments. Indicating instruments. Recording instruments. Integrating instruments. Digital instruments. Analog instruments.   * ENERGY METER SINGLE PHASE AND THREE PHASE: Types. Construction of single phase Energy meter (induction type). Working Principle. Types of scales in use and reading the scale. * INSTRUMENT TRANSFORMERS: Types (C.T & P.T). Working and advantages. Theory of C.T & P.T, Standard ratios. * SUB-STATION.   + Classification of Substation   + Equipment installed in Sub-station and its purpose   + Bus Bar arrangements. * GROUNDING AND INSULATION:   + star Neutral point,   + Necessity of grounding.     - Solid grounding.     - Resistance grounding.     - Reactance grounding. * Circuit Breaker   + Phenomena of arc & its effects.   + Magnitude of arc,   + Maintenance of arc (Arc quenching),   + Operating Principle of Oil circuit breakers, Air circuit breakers, Gas circuit breakers, Vacuum circuit breakers.   + Parts of Circuit breaker * Isolators   + Working principle.   + Uses. * Difference between CB & Isolator PROTECTIVE RELAYING:   + Necessity of relaying.   + Concept of Primary and backup Protection,   + Type of Faults in Power System,   + Symmetrical and asymmetrical faults * TRANSFORMER OPERATION AND PROTECTION   + Transformer Faults and Protection relays   + Transformer Tap Changer   + Concept of Bucholz Relay   + Concept of Transformer Star-Delta Connection * Transmission Line:   + OVERHEAD LINE CONDUCTORS: Type of conductor   + Concept of Sag   + Concept of Skin Effect, Ferranti Effect, Corona effect   + Difference between ACSR and AAAC   + Type of insulators   + Voltage drop in H.V. transmission lines * Power System fundamentals:   + Import & Export Energy,   + Concept of Active and Reactive Power,   + Power Triangle. * AC Machines:   + Working Principle of Transformer, AC Motor, Synchronous Generator, Synchronous motors, * Tools & Plant   + Fundamental of Electrical Maintenance:   + Scheduled maintenance   + Minor repairs, Major repairs, overhaul   + Tools and Equipment used for repair work.   Understand The Operations Of Lathe And Grinders:   * parts of lathe and grinder. * functions of lathe. * different types of threads and their measuring tools. * Measure thread with thread gauge * Safety rules to be observed during repair work * Understand HT& L.T Power Cables –   + Concept of Cables (Heat Resistant, Fire Retarding, Welding Cables)   + Joint of Conductors and Power cables |
| 3 | Line Superintendent-I (BPS-15) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies **(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs **(15 Marks)**   a) Professional/ Technical Knowledge as per their qualification and experience given in the advertisement of each category of the posts. **(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**  **Basic Course Contents**   * Resistance, Capacitance, Inductor and their equivalence in Series and Parallel combination and Impedance calculation, Resistivity, Conductance and Conductivity, effect of Temperature on Resistance and Temperature Coefficient. * RC, LC, RLC Circuits, Thevenin’s and Norton’s Equivalent Circuit, Maximum Power Transfer Theorem, Star-Delta Connections. * Fundamentals of Current, Voltage, RMS value, cycle, period, frequency, amplitude, Instantaneous value. * Ohm’s Law and Kirchhoff’s Law, Loop and Mesh Analysis. * Generation of 2-phase, 3-phase E.M.F. and phase sequence. * Electrical Power, types of Power (actual, apparent, reactive), Power Triangle, Power Factor, calculation of   kilowatt hour.   * Electromagnetism (Lenz’s law, Faraday’s law)   **Intermediate Course Contents**   * Doping in Semi-Conductors (P-type, N-Type) * Diodes (photoelectric, Zener), Transistors (PNP, NPN, BJT, MOSFET), Thyristors, IGBTs, DIAC, TRIAC. * Half-wave, full-wave rectification. * Logic Gates and Flip Flops * AC Machines (Transformers, Motors, Generators) (Synchronous and Asynchronous Machines) * Open Circuit tests and Short Circuit Tests. * DC Motors (Series and Shunt motors) * Household Wiring (Earthing system, fault current, wiring tests) * Types of Insulator (Pin, Suspension, Strain, Shackle), Material of Insulators, Flashover and Puncture Voltage. * Corona Effect, Ferranti Effect, Skin Effect. * Fundamentals of HVDC and HVAC Transmission Systems * Types of Poles and Towers, Parts of Towers, Types of Conductor, Sag in Conductor Lines, Ground Clearance. * Components of Switchyard (CT, PT, Breakers, CCVT, Wavetraps, Isolators) * Busbar and Breaker Schemes (One and half Scheme, Single busbar single breaker, Double busbar single breaker, Double busbar double breaker etc) * Grounding Schemes (Solid grounding, Resistance grounding) * Fault Current Limiting Devices.   Types of Circuit Breakers (Air, Oil, SF6) (Spring, Hydraulic mechanism) and Arc Resistance   * Industrial Electronics (AC, DC motor controls, A/D, D/A Converters, SCR etc) * Hysteresis losses and Eddy current losses. * Common types of faults on Alternator, Transformer, Busbar. * Low-pass filters and High-pass filters   **Advance Course Contents**   * Protection of Electrical Systems (Protection Schemes of Transformers, Busbars, Transmission Lines, Over- voltage/Under-voltage protection, Overcurrent Protection, Over-frequency/under-frequency protection, Earth Fault Protection, Buchholz’s Relay * Types of Fault (Single phase, Double phase, triple phase, neutral faults, Symmetrical and Asymmetrical Faults etc) * Methods of fault locating in overhead and underground lines. * Distance Relays and their working * T-Model and Pi-Model of Transmission lines * Use of Shunt Reactors on Transmission Lines. * Efficiency of Power Plants. * Renewable energy sources (Working of PV cells, Working of Wind Mills etc)   Harmonics and Transients. |
| 4 | Foreman (BPS-15) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies **(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs **(15 Marks)**   a) Professional/ Technical Knowledge as per their qualification and experience given in the advertisement of each category of the posts. **(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**   * Tools & Plant   + Fundamental of Electrical Maintenance:   + Scheduled maintenance   + Minor repairs, Major repairs, overhaul * Tools and Equipment used for repair work. * Understand The Operations Of Lathe And Grinders:   + parts of lathe and grinder.   + functions of lathe.   + different types of threads and their measuring tools.   + Measure thread with thread gauge * Safety rules to be observed during repair work * Understand HT& L.T Power Cables –   + Concept of Cables (Heat Resistant, Fire Retarding, Welding Cables)   + Joint of Conductors and Power cables * Introduction to welding process and welding equipment’s.   + Welding process.   + Welding torches. Gas cylinders.   + Pressure gauges. * Electrical Wiring   + Wiring basics   + Types and sizes of wiring cables according to voltage grade, core and strands, Insulation.   + Wiring accessories and cables current carrying capacity.   + Uses of technical drawing, tools and equipment’s.   + Types of drawings and their uses. * Computer Applications   + Networking (LAN, WAN, Network, Internet, Browsing and Surfing)   + Basics of computers   + Input and Output Devices   + MS (Office - Word and Power Point) Application * Electrical Instrumentation   Errors In Am-Meters And Voltmeters   * Multiplier: Purpose Of Multiplier, Its Calculations And Construction * Classification Of Instruments: Absolute Instruments. Secondary Instruments. Indicating Instruments. Recording Instruments. Integrating Instruments. Digital Instruments. Analog Instruments. * Energy Meter Single Phase And Three Phase: Types. Construction Of Single Phase Energy Meter (Induction Type). Working Principle. Types Of Scales In Use And Reading The Scale. * Instrument Transformers: Types (C.T & P.T). Working And Advantages. Theory Of C.T & P.T, Standard Ratios. * Sub-Station:   + Classification of Substation   + Equipment installed in Sub-station and its purpose   + Bus Bar arrangements. * Circuit Breaker:   + Phenomena of arc & its effects.   + Magnitude of arc   + Maintenance of arc (Arc quenching)   + Operating Principle of Oil circuit breakers, Air circuit breakers, Gas circuit breakers, Vacuum circuit breakers.   + Parts of Circuit breaker * Isolators   + Working principle.   + Uses of Isolator   + Difference between CB & Isolator * Grounding And Insulation:   star Neutral point   * Necessity of grounding.   + Solid grounding.   + Resistance grounding.   + Reactance grounding. * Transformer Operation And Protection   + Transformer Faults and Protection relays   + Transformer Tap Changer   + Concept of Bucholz Relay   + Concept of Transformer Star-Delta Connection * Transmission Line:   + OVERHEAD LINE CONDUCTORS: Type of conductor   + Concept of Sag   + Concept of Skin Effect, Ferranti Effect, Corona effect   + Difference between ACSR and AAAC   + Type of insulators   + Voltage drop in H.V. transmission lines * Power System fundamentals:   + Import & Export Energy,   + Concept of Active and Reactive Power,   + Power Triangle. * AC Machines:   Working Principle of Transformer, AC Motor, Synchronous Generator, Synchronous motors |
| 5 | Telecom Supervisor (BPS-15) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies**(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs**(15 Marks)**   Professional/ Technical Knowledge as per their qualification and experience given in the advertisement of each category of the posts.**(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**  **DIODES AND APPLICATIONS.**   * Semi-Conductors. * Semi-Conductor doping * Intrinsic & extrinsic semi-conductor * Biasing the PNjunction. * Depletion region,Junctionbarrier potential * Forward and reverse bias. * Rectifier Diode.   **CIRCUIT DIAGRAMS OF**:   * Half wave rectifier. * Full wave rectifier. * Common emitteramplifier. * Push pull power amplifier.   **ELECTROSTATIC FIELDS**   * Coulomb’s Law andfield intensity. * Electric Field due to continuous chargedistribution formulae. * Electric Flux density * Gauss’s Law andits application toa pointcharge * Electric potential * Relationship between E & V * Electric Dipole   **TRANSMISSION LINES**   * Introduction to Transmission Lines * Transmission Line Parameters * Transmission Line Equations * Input Impedance, SWR and Power   **WAVEGUIDES**   * Introduction toWaveguides * Rectangular Wave Guide * Rectangular Wave Guide Modes * Circular Waveguides   **ANTENNAS**   * HertzianDipole * Half Wave Dipole Antenna * Quarter Wave mono pole Antenna * Antenna Characteristics   **SIGNAL GENERATORS.**   * AF generator. * RF generator. * AM generator. * FM generator. * Squareand Pulsegenerator. * Function generator.   **CALIBRATION OF MEASURING INSTRUMENTS.**   * Standards of Calibration of Measuring Instruments. * The techniques ofcalibration ofMeasuringInstruments. * Explain the common faults in DigitalInstruments withtheir symptoms, causes and remedies   **MODULATION AND DEMODULATION**   * Definition ofModulation and De-Modulation * Needs of Modulation and De-Modulation * Types ofModulation * AM Receiver * Block diagram of super-heterodyne receiver. * Principle of super-heterodyning. * Operation of each stage ofsuper-heterodyne receiver * Block diagram explanationof F.M receiver. * AM Transmitter * Transmission system (Block Diagram). * Amplitude modulation. * Transmission Techniques, SSB, DSB with the help of blockdiagram. * Principles offrequency modulation. * System of FM modulation blockdiagram. * Merits and demerits of FM.   **TELEPHONY.**   * Automatic telephone system. * Telephone Instruments, receiver, transmitter, bell. * Tone dialing, TDMF (dualtone multi-frequency). * Standard telephone set. * Automatic telephone exchange. * Telephone traffic &trunking principle. * Block diagram of digital Telephone Exchange. * Pulse code modulation (PCM) * Multiplexing, Time Division Multiplexing ( TDM) * Digital Switching Time Switching and Space switching. * Data Communication. * Modem, Fax Machine * Internet Communication. * VoIP 4.   **FIBER OPTICS**   * Optical Fiber for light wave communication. * Propagation * Fiber Opticstransmission system. * Video Telephone & Video conferencing. * Merits and Demerits of Fiber Optic Communication. * Optical Transmittingand Receiving Devices * Wave DivisionMultiplexing   **RESONANCE.**   * Relationbetweenf, L and C at resonance. * Series resonantcircuit.Impedance ofseriesresonant circuit. * Current, voltage and impedance characteristic of series resonant circuit. * Parallel resonant circuit and its impedance * Characteristics of impedance, current and voltage of a parallel resonant circuit * Series and parallelresonance curve comparison and Bandwidth. * **FILTER & COUPLING CIRCUITS** * Purpose and action of afilter circuit. Types offilter circuit LPF,HPF, K filter and m drive filter. * Band Passfilter (BPF) Band Stopfilter (BSF) * Purpose and action of couplingcircuit. * Type of coupling, RC, Impedancetransformer coupling.   **UNDERSTAND BATTERIES**   * Types of D.C source * Types of cells (Mercury, Silver oxide, Nickel cadmium) * Lead acid battery * Solar cells * Cells inseries and parallelof voltage and constant source of current   **NUMBER SYSTEM.**   * Convert Binary numbers into Decimal numbers. * Convert Decimal numbers into Binary numbers. * Convert Hexadecimal numbers into Binary numbers. * Convert Binary numbers into Hexadecimal numbers. * Convert Hexadecimal numbers into Decimal numbers. * Convert Decimal numbers into Hexadecimalnumbers.   **LOGIC GATES.**   * Draw Symbols of OR gate. * Draw Circuit oftwo inputOR gate. * Function of OR gate. * Describe Truth Table of OR gate. * Describe Boolean expression for OR gate. |
| 6 | Sub Station Operator-II (BPS-14) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies **(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs **(15 Marks)**   a) Professional/ Technical Knowledge as per their qualification and experience given in the advertisement of each category of the posts. **(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**   * Computer Applications   + Networking (LAN, WAN, Network, Internet, Browsing and Surfing)   + Basics of computers   + Input and Output Devices   + MS (Office - Word and Power Point) Application * Electrical Instrumentation   + ERRORS IN AM-METERS AND VOLTMETERS   + MULTIPLIER: Purpose of multiplier, its calculations and Construction   + CLASSIFICATION OF INSTRUMENTS: Absolute instruments. Secondary instruments. Indicating instruments. Recording instruments. Integrating instruments. Digital instruments. Analog instruments.   ENERGY METER SINGLE PHASE AND THREE PHASE: Types. Construction of single phase Energy meter (induction type). Working Principle. Types of scales in use and reading the scale.  o INSTRUMENT TRANSFORMERS: Types (C.T & P.T). Working and advantages. Theory of C.T & P.T, Standard ratios.   * SUB-STATION.   + Classification of Substation   + Equipment installed in Sub-station and its purpose   + Bus Bar arrangements. * GROUNDING AND INSULATION:   + star Neutral point,   + Necessity of grounding.     - Solid grounding.     - Resistance grounding.     - Reactance grounding. * Circuit Breaker   + Phenomena of arc & its effects.   + Magnitude of arc,   + Maintenance of arc (Arc quenching),   + Operating Principle of Oil circuit breakers, Air circuit breakers, Gas circuit breakers, Vacuum circuit breakers.   + Parts of Circuit breaker * Isolators   + Working principle.   + Uses.   + Difference between CB & Isolator * PROTECTIVE RELAYING:   + Necessity of relaying.   + Concept of Primary and backup Protection,   + Type of Faults in Power System,   + Symmetrical and asymmetrical faults   TRANSFORMER OPERATION AND PROTECTION   * Transformer Faults and Protection relays * Transformer Tap Changer * Concept of Bucholz Relay * Concept of Transformer Star-Delta Connection * Transmission Line:   + OVERHEAD LINE CONDUCTORS: Type of conductor   + Concept of Sag   + Concept of Skin Effect, Ferranti Effect, Corona effect   + Difference between ACSR and AAAC   + Type of insulators   + Voltage drop in H.V. transmission lines * Power System fundamentals:   + Import & Export Energy,   + Concept of Active and Reactive Power,   + Power Triangle. * AC Machines:   + Working Principle of Transformer, AC Motor, Synchronous Generator, Synchronous motors, * Tools & Plant   + Fundamental of Electrical Maintenance:   + Scheduled maintenance   + Minor repairs, Major repairs, overhaul   + Tools and Equipment used for repair work.   + Understand The Operations Of Lathe And Grinders:     - parts of lathe and grinder.     - functions of lathe.     - different types of threads and their measuring tools.     - Measure thread with thread gauge * Safety rules to be observed during repair work Understand HT& L.T Power Cables –   + Concept of Cables (Heat Resistant, Fire Retarding, Welding Cables)   + Joint of Conductors and Power cables |
| 7 | Line Superintendent-II (BPS-14) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies **(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs **(15 Marks)**   a) Professional/ Technical Knowledge as per their qualification and experience given in the advertisement of each category of the posts. **(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**  **Basic Course Contents**   * Resistance, Capacitance, Inductor and their equivalence in Series and Parallel combination and Impedance calculation, Resistivity, Conductance and Conductivity, effect of Temperature on Resistance and Temperature Coefficient. * RC, LC, RLC Circuits, Thevenin’s and Norton’s Equivalent Circuit, Maximum Power Transfer Theorem, Star-Delta Connections. * Fundamentals of Current, Voltage, RMS value, cycle, period, frequency, amplitude, Instantaneous value. * Ohm’s Law and Kirchhoff’s Law, Loop and Mesh Analysis. * Generation of 2-phase, 3-phase E.M.F. and phase sequence. * Electrical Power, types of Power (actual, apparent, reactive), Power Triangle, Power Factor, calculation of kilowatt hour. * Electromagnetism (Lenz’s law, Faraday’s law)   **Intermediate Course Contents**   * Doping in Semi-Conductors (P-type, N-Type)   Diodes (photoelectric, Zener), Transistors (PNP, NPN, BJT, MOSFET), Thyristors, IGBTs, DIAC, TRIAC.   * Half-wave, full-wave rectification. * Logic Gates and Flip Flops * AC Machines (Transformers, Motors, Generators) (Synchronous and Asynchronous Machines) * Open Circuit tests and Short Circuit Tests. * DC Motors (Series and Shunt motors) * Household Wiring (Earthing system, fault current, wiring tests) * Types of Insulator (Pin, Suspension, Strain, Shackle), Material of Insulators, Flashover and Puncture Voltage. * Corona Effect, Ferranti Effect, Skin Effect. * Fundamentals of HVDC and HVAC Transmission Systems * Types of Poles and Towers, Parts of Towers, Types of Conductor, Sag in Conductor Lines, Ground Clearance. * Components of Switchyard (CT, PT, Breakers, CCVT, Wavetraps, Isolators) * Busbar and Breaker Schemes (One and half Scheme, Single busbar single breaker, Double busbar single breaker, Double busbar double breaker etc) * Grounding Schemes (Solid grounding, Resistance grounding) * Fault Current Limiting Devices. * Types of Circuit Breakers (Air, Oil, SF6) (Spring, Hydraulic mechanism) and Arc Resistance * Industrial Electronics (AC, DC motor controls, A/D, D/A Converters, SCR etc) * Hysteresis losses and Eddy current losses. * Common types of faults on Alternator, Transformer, Busbar. * Low-pass filters and High-pass filters   **Advance Course Contents**   * Protection of Electrical Systems (Protection Schemes of Transformers, Busbars, Transmission Lines, Over- voltage/Under-voltage protection, Overcurrent Protection, Over-frequency/under-frequency protection, Earth Fault Protection, Buchholz’s Relay * Types of Fault (Single phase, Double phase, triple phase, neutral faults, Symmetrical and Asymmetrical Faults etc) * Methods of fault locating in overhead and underground lines. * Distance Relays and their working * T-Model and Pi-Model of Transmission lines * Use of Shunt Reactors on Transmission Lines. * Efficiency of Power Plants. * Renewable energy sources (Working of PV cells, Working of Wind Mills etc) * Harmonics and Transients. |
| 8 | Assistant Foreman (BPS-14) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies **(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs **(15 Marks)**   Professional/ Technical Knowledge as per their qualification and experience given in the advertisement of each category of the posts. **(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**   * Tools & Plant   + Fundamental of Electrical / Mechanical Maintenance:   + Scheduled maintenance   + Minor repairs, Major repairs, overhauls   + Tools and Equipment used for repair work Electrically / Mechanically.   + Understand The Operations Of Lathe And Grinders.   + parts of lathe and grinder. * functions of lathe. * different types of threads and their measuring tools. * Measure thread with thread gauge * UNDERSTAND HT & L.T POWER CABLES –   + Concept of Cables (Heat Resistant, Fire Retarding, Welding Cables)   + Joint of Conductors and Power cables * Introduction to welding process and welding equipment’s.   + Welding process.   + Welding torches. Gas cylinders.   + Pressure gauges.   + Type of Welding * Safety rules to be observed during repair work * Electrical Wiring   + Wiring basics   + Types and sizes of wiring cables according to voltage grade, core and strands, Insulation.   + Wiring accessories and cables current carrying capacity.   + Uses of technical drawing, tools and equipment’s.   + Types of drawings and their uses. * Computer Applications   + Networking (LAN, WAN, Network, Internet, Browsing and Surfing)   + Basics of computers   + Input and Output Devices * Electrical Instrumentation   + Errors In Am-Meters And Voltmeters   + Multiplier: Purpose Of Multiplier, Its Calculations And Construction   + Classification Of Instruments: Absolute   Instruments. Secondary Instruments. Indicating Instruments. Recording Instruments. Integrating Instruments. Digital Instruments. Analog Instruments.   * Energy Meter Single Phase And Three Phase: Types. Construction Of Single Phase Energy Meter (Induction Type). Working Principle. Types Of Scales In Use And Reading The Scale. * Instrument Transformers: Types (C.T & P.T). Working And Advantages. Theory Of C.T & P.T, Standard Ratios. * Sub-Station.   + Classification of Substation   + Equipment installed in Sub-station and its purpose   + Bus Bar arrangements. * Circuit Breaker   + Phenomena of arc & its effects.   + Magnitude of arc   + Maintenance of arc (Arc quenching)   + Operating Principle of Oil circuit breakers, Air circuit breakers, Gas circuit breakers, Vacuum circuit breakers.   + Parts of Circuit breaker * Isolators   + Working principle.   + Uses.   + Difference between CB & Isolator * Grounding And Insulation:   + star Neutral point,   + Necessity of grounding.     - Solid grounding.   + Resistance grounding. * Reactance grounding. * Transformer Operation And Protection   + Transformer Faults and Protection relays   + Transformer Tap Changer   + Concept of Bucholz Relay   + Concept of Transformer Star-Delta Connection * Transmission Line:   + Overhead Line Conductors: Type of conductor   + Concept of Sag   + Concept of Skin Effect, Ferranti Effect, Corona effect   + Difference between ACSR and AAAC   + Type of insulators   + Voltage drop in H.V. transmission lines * Power System fundamentals:   + Import & Export Energy,   + Concept of Active and Reactive Power,   + Power Triangle. * AC Machines:   + Working Principle of Transformer, AC Motor, Synchronous Generator, Synchronous motors |
| 9 | Laboratory Assistant (BPS-14) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies **(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs **(15 Marks)**   Professional/ Technical Knowledge as per their qualification and experience given in the advertisement of each category of the posts. **(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**   |  |  |  | | --- | --- | --- | | **Section**  **A** | **Basic Electronics & Measuring systems.** | **20** | | Sub- Section  A-i: | Basic Electronics, Rectifiers, Converter, Thyristors. | 10 | | Sub- Section  A-ii: | Resistors, Capacitors, Inductors, Measuring Units (V, A, Watt, Var) &  Measuring Systems ,Power Factor | 10 | | **Section**  **B** | **Grid Station Equipment & Protection**  **systems.** | **20** | | Sub- Section  B-i: | Basics of Transformers (Power Transformers/DistributionTreanformer)/  Transmission lines CT's PT's | 10 | | Sub- Section  B-ii: | Protection systems of Transformer and Transmission lines, Circuit Breakers,  Disconnecting Switches, Bus Bars. | 10 | | **Section**  **C** | **AC and DC machines fundamentals.** | **20** | | Sub- Section  C-i: | DC battery, DC Machines. | 10 | | Sub- Section  C-ii: | AC Machines, Induction, Synchronous motors and Genrators. | 10 | | **Grand Total** | | **60** |   The syllabus for the posts of Test inspector BPS 15 and Lab Assistant BPS 14 is same however the paper difficulty level for both will be different. |
| 10 | Cable Jointer (BPS-14) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies**(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs**(15 Marks)**   Professional/ Technical Knowledge as per their qualification and experience given in the advertisement of each category of the posts.**(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**   * Basic Electricity Principles * Introduction to safety, its importance * Earthing and types of earthing * Introduction of Power Cable and Conductors, its parts and types. * Measuring Instruments. * Size of cables and their current carrying capacity * Methods of installation/laying of power cable * Maintenance/Testing of power cable * Types of Joints of power cable * Tools and equipment used in cable jointing * Types and method of Power Cable Termination * Method of Fault Location test for power cable * Method of cable splicing * Heat Shrink Joints |
| 11 | Telecom Mechanic-I (BPS-14) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies **(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs **(15 Marks)**   a) Professional/ Technical Knowledge as per their qualification and experience given in the advertisement of each category of the posts. **(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**  **Job Related Course Content (60 Marks) Must Include:**  ***DIODES AND APPLICATIONS.***   * *Semi-Conductors.* * *Semi-Conductor doping* * *Intrinsic & extrinsic semi-conductor* * *Biasing the PNjunction.* * *Depletion region,Junctionbarrier potential* * *Forward and reverse bias.* * *Rectifier Diode.*   ***CIRCUIT DIAGRAMS OF****:*   * *Half wave rectifier.* * *Full wave rectifier.* * *Common emitteramplifier.* * *Push pull power amplifier.*   ***ELECTROSTATIC FIELDS***   * *Coulomb’s Law andfield intensity.* * *Electric Field due to continuous chargedistribution formulae.* * *Electric Flux density* * *Gauss’s Law andits application toa pointcharge* * *Electric potential* * *Relationship between E & V* * *Electric Dipole*   ***TRANSMISSION LINES***   * *Introduction to Transmission Lines* * *Transmission Line Parameters* * *Transmission Line Equations* * *Input Impedance, SWR and Power*   ***WAVEGUIDES***   * *Introduction toWaveguides* * *Rectangular Wave Guide* * *Rectangular Wave Guide Modes* * *Circular Waveguides*   ***ANTENNAS***   * *Hertzian Dipole* * *Half Wave Dipole Antenna* * *Quarter Wave mono pole Antenna* * *Antenna Characteristics*   ***SIGNAL GENERATORS.***   * *AF generator.* * *RF generator.* * *AM generator.* * *FM generator.* * *Squareand Pulsegenerator.* * *Function generator.*   ***CALIBRATION OF MEASURING INSTRUMENTS.***   * *Standards of Calibration of Measuring Instruments.* * *The techniques ofcalibration ofMeasuringInstruments.* * *Explain the common faults in DigitalInstruments withtheir symptoms, causes and remedies*   ***MODULATION AND DEMODULATION***   * *Definition ofModulation and De-Modulation* * *Needs of Modulation and De-Modulation* * *Types ofModulation* * *AM Receiver* * *Block diagram of super-heterodyne receiver.* * *Principle of super-heterodyning.* * *Operation of each stage ofsuper-heterodyne receiver* * *Block diagram explanationof F.M receiver.* * *AM Transmitter* * *Transmission system (Block Diagram).* * *Amplitude modulation.* * *Transmission Techniques, SSB, DSB with the help of blockdiagram.* * *Principles offrequency modulation.* * *System of FM modulation blockdiagram.* * *Merits and demerits of FM.*   ***TELEPHONY.***   * *Automatic telephone system.* * *Telephone Instruments, receiver, transmitter, bell.* * *Tone dialing, TDMF (dualtone multi-frequency).* * *Standard telephone set.* * *Automatic telephone exchange.* * *Telephone traffic &trunking principle.* * *Block diagram of digital Telephone Exchange.* * *Pulse code modulation (PCM)* * *Multiplexing, Time Division Multiplexing ( TDM)* * *Digital Switching Time Switching and Space switching.* * *Data Communication.* * *Modem, Fax Machine* * *Internet Communication.* * *VoIP 4.*   ***FIBER OPTICS***   * *Optical Fiber for light wave communication.* * *Propagation* * *Fiber Opticstransmission system.* * *Video Telephone & Video conferencing.* * *Merits and Demerits of Fiber Optic Communication.* * *Optical Transmittingand Receiving Devices* * *Wave DivisionMultiplexing*   ***RESONANCE.***   * *Relationbetweenf, L and C at resonance.* * *Series resonantcircuit.Impedance ofseriesresonant circuit.* * *Current, voltage and impedance characteristic of series resonant circuit.* * *Parallel resonant circuit and its impedance* * *Characteristics of impedance, current and voltage of a parallel resonant circuit* * *Series and parallelresonance curve comparison and Bandwidth.* * ***FILTER & COUPLING CIRCUITS*** * *Purpose and action of afilter circuit. Types offilter circuit LPF,HPF, K filter and m drive filter.* * *Band Passfilter (BPF) Band Stopfilter (BSF)* * *Purpose and action of couplingcircuit.* * *Type of coupling, RC, Impedancetransformer coupling.*   ***UNDERSTAND BATTERIES***   * *Types of D.C source* * *Types of cells (Mercury, Silver oxide, Nickel cadmium)* * *Lead acid battery* * *Solar cells* * *Cells inseries and parallelof voltage and constant source of current*   ***NUMBER SYSTEM.***   * *Convert Binary numbers into Decimal numbers.* * *Convert Decimal numbers into Binary numbers.* * *Convert Hexadecimal numbers into Binary numbers.* * *Convert Binary numbers into Hexadecimal numbers.* * *Convert Hexadecimal numbers into Decimal numbers.* * *Convert Decimal numbers into Hexadecimalnumbers.*   ***LOGIC GATES.***   * *Draw Symbols of OR gate.* * *Draw Circuit oftwo inputOR gate.* * *Function of OR gate.* * *Describe Truth Table of OR gate.* * *Describe Boolean expression for OR gate.* |
| 12 | Telecom Mechanic-II (BPS-12) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies **(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs **(15 Marks)**   Professional/ Technical Knowledge as per their qualification and experience given in the advertisement of each category of the posts. **(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**  ***DC SOURCE & BATTERIES***   * *Types of D.C source* * *Types of cells (Mercury, Silver oxide, Nickel cadmium)* * *Lead acid battery* * *Solar cells* * *Cells inseries and parallelof voltage and constant source of current*   ***CIRCUIT DIAGRAMS OF****:*   * *Half wave rectifier.*  *Full wave rectifier.*  *Common emitteramplifier.*   ***ELECTROSTATIC FIELDS***   * *Coulomb’s Law andfield intensity.* * *Electric Flux density* * *Gauss’s Law andits application toa pointcharge* * *Electric potential* * *Electric Dipole*   ***CALIBRATION OF MEASURING INSTRUMENTS.***   * *Standards of Calibration of Measuring Instruments.* * *The techniques ofcalibration ofMeasuringInstruments* * *Explain the common faults in DigitalInstruments withtheir symptoms, causes and remedies*   ***MODULATION AND DEMODULATION***   * *Definition ofModulation and De-Modulation* * *Needs of Modulation and De-Modulation* * *Types ofModulation* * *AM Receiver* * *Block diagram of super-heterodyne receiver.* * *Operation of each stage ofsuper-heterodyne receiver* * *Block diagram explanationof F.M receiver.* * *AM Transmitter* * *Transmission system (Block Diagram)* * *Amplitude modulation* * *Principles offrequency modulation.* * *Merits and demerits of FM.*   ***TELEPHONY.***   * *Automatic telephone system.* * *Telephone Instruments, receiver, transmitter, bell.* * *Tone dialing, TDMF (dualtone multi-frequency).* * *Standard telephone set.* * *Automatic telephone exchange.* * *Telephone traffic &trunking principle.* * *Pulse code modulation (PCM)* * *Multiplexing, Time Division Multiplexing ( TDM)* * *Digital Switching Time Switching and Space switching.* * *Data Communication.* * *Modem, Fax Machine* * *Internet Communication.*   ***LASERS***   * *Corpuscular theory oflight* * *Emission andabsorption of light* * *Stimulated absorption andemission oflight*  *Laser principle* * *Types oflasers with brief description.* * *Applications (basic concepts)*   ***FIBER OPTICS***   * *Optical Fiber for light wave communication.* * *Propagation* * *Fiber Opticstransmission system.* * *Merits and Demerits of Fiber Optic Communication.* * *Optical Transmittingand Receiving Devices* * *Wave DivisionMultiplexing*   ***RESONANCE.***   * *Current, voltage and impedance characteristic of series resonant circuit.* * *Parallel resonant circuit and its impedance* * *Characteristics of impedance, current and voltage of a parallel resonant circuit.* * *Series and parallelresonance curve comparison and Bandwidth.*   ***FILTER & COUPLING CIRCUITS***  *Purpose and action of afilter circuit.* *Types offilter circuit LPF,HPF, K filter and m drive filter.*   * *Band Passfilter (BPF) Band Stopfilter (BSF)* * ***DIODES AND APPLICATIONS.*** * *Semi-Conductors.* * *Semi-Conductor doping* * *Intrinsic & extrinsic semi-conductor* * *Depletion region,Junctionbarrier potential* * *Forward and reverse bias.*   ***NUMBER SYSTEM***   * *Convert Binary numbers into Decimal numbers.*  *Convert Decimal numbers into Binary numbers.*  *Convert Hexadecimal numbers into Binary numbers.* * *Convert Binary numbers into Hexadecimal numbers.* * *Convert Hexadecimal numbers into Decimal numbers.* * *Convert Decimal numbers into Hexadecimalnumbers.*   ***LOGIC GATES.***   * *Draw Symbols of OR gate.* * *Draw Circuit oftwo inputOR gate.* * *Function of OR gate.* * *Describe Truth Table of OR gate.* * *Describe Boolean expression for OR gate.*   ***LAWS OF RESISTANCE***   * *Define specific resistance* * *Define conductor* * *Define conductivity* * *Explain the effect oftemperature on resistance* * *Explain coefficient of resistance* * *Describe the resistance inseries* * *Describe the resistance in parallel* * *Describe the resistance inseries-parallel* * *Define power and energy* * *Describe units of power and energy* * *Explain the power dissipation inresistors* |
| 13 | Electrician-I (BPS-11) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies **(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs **(15 Marks)**   Professional/ Technical Knowledge as per their qualification and experience given in the advertisement of each category of the posts. **(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**   * Understand Basic Concepts Of Electricity   + conductor, Insulator & semi- conductor.   + Resistance, conductance, electrical current, potential difference and state its unit.   + Ohm`s law.   + Explain laws of resistance and calculations.   + effects of temperature on Resistance.   + series and parallel circuits with their properties.   + total resistances in series & parallel circuits.   + division of voltage in series circuits.   + division of current in parallel circuits. * Electrical Wiring   + Wiring basics   + Types and sizes of wiring cables according to voltage grade, core and strands, Insulation.   + Wiring accessories and cables current carrying capacity.   + Uses of technical drawing, tools and equipment’s.   + fuse, miniature circuit breaker.   + List the parts of fuse & M.C.B. * Compare the advantages & disadvantages of fuse & M.C.B. * Different wiring tests * Circuits of basic life appliances like Tube lights, fan, Motors, Pumps,   Distribution board   * Working and Wiring of UPS * Single Line diagram, Types of drawings and their uses. * Electrical Instrumentation   + Errors In Am-Meters And Voltmeters   + Multiplier: Purpose Of Multiplier   + Classification Of Instruments: Absolute Instruments. Secondary Instruments. Indicating Instruments. Recording Instruments. Integrating Instruments. Digital Instruments. Analog Instruments.   + Energy Meter Single Phase And Three Phase: Types. Construction Of Single Phase Energy Meter (Induction Type). Working Principle And Reading The Scale.   + Instrument Transformers: Types (C.T & P.T). Working And Advantages. Theory Of C.T & P.T   + Motor Circuit, Motor Forward And Reverse Circuit   + Star-Delta Connection * Understand HT & L.T Power Cables –   + Concept Of Cables (Heat Resistant, Fire Retarding, Welding Cables) * Joint Of Conductors And Power Cables * Grounding And Insulation:   + Star Neutral Point   + Necessity Of Grounding.     - Solid Grounding.   + Resistance Grounding. Reactance Grounding. |
| 14 | Crane Operator-I (BPS-11) | **General/ Professional/ Technical: (Total 85 Marks)**   1. Islamic Studies **(10 Marks)** 2. Pakistan Studies, General Knowledge/ Current Affairs **(15 Marks)**   Professional/ Technical Knowledge as per their qualification and experience given in the advertisement of each category of the posts. **(60 Marks)** | **Job Related Course Content (60 Marks) Must Include:**   * Crane types and components * Crane setup * Crane safety * Hand and Radio signals * Technical accuracy * Emergency stop operation and disconnect * Safe and productive lifting techniques * Crane control operations |